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THE AMERICAN ENGINEER.

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JULY 4, 1891. The American Engineer. VOL. 22, NO. 1.

LEFFEL STEAM ENGINES AND BOILERS.

The accompanying illustrations represent some of the latest improvements in engines and boilers, built by the well-known firm of the James Leffel & Co., of Springfield, Ohio.

Fig. 1 represents their horizontal crank center engine; and Fig. 2 shows the same engine combined with a self-contained return tubular boiler. Fig. 3 illustrates their upright engine and boiler combin'd. And Fig. 4 represents the upright steel boiler with submerged upper tube sheet. The improvements made in the Leffel engines and boilers are the result of many years of experience in making steam outfits on an extensive scale.

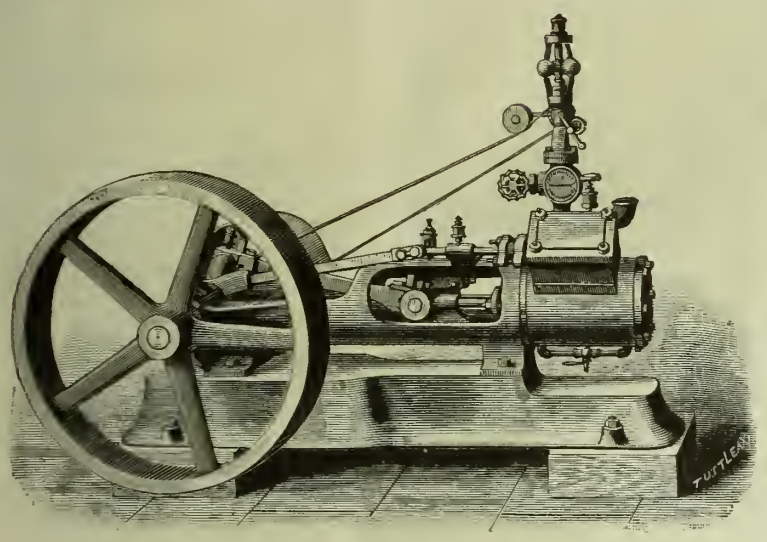


Fig. 1.

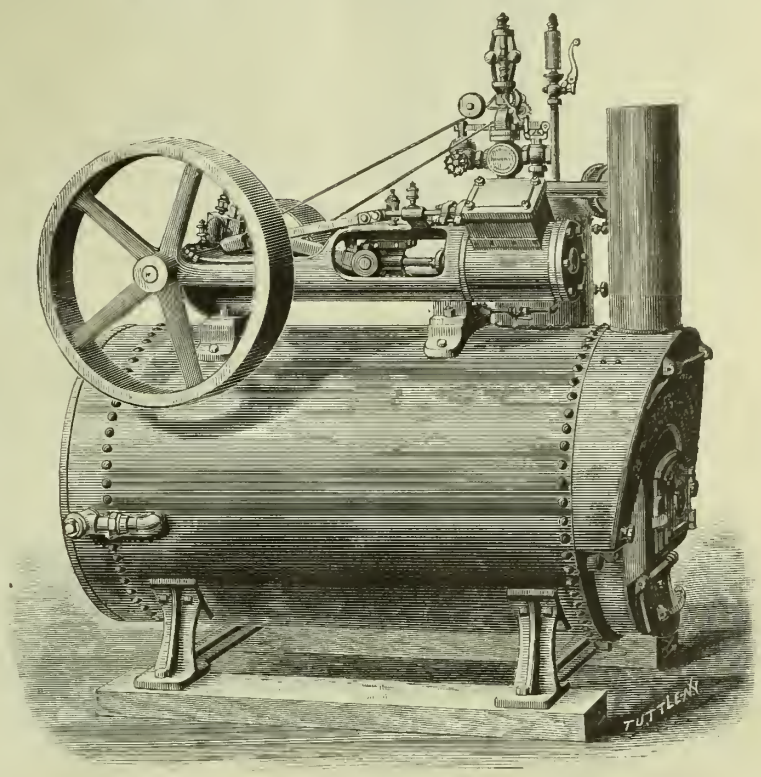


Fig. 2.

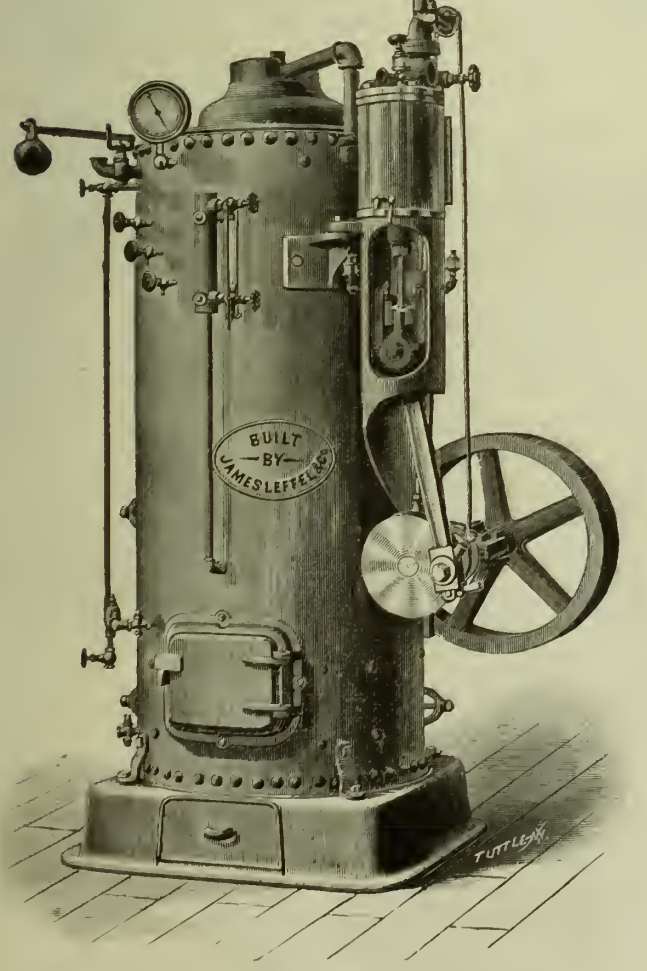


Fig. 3.

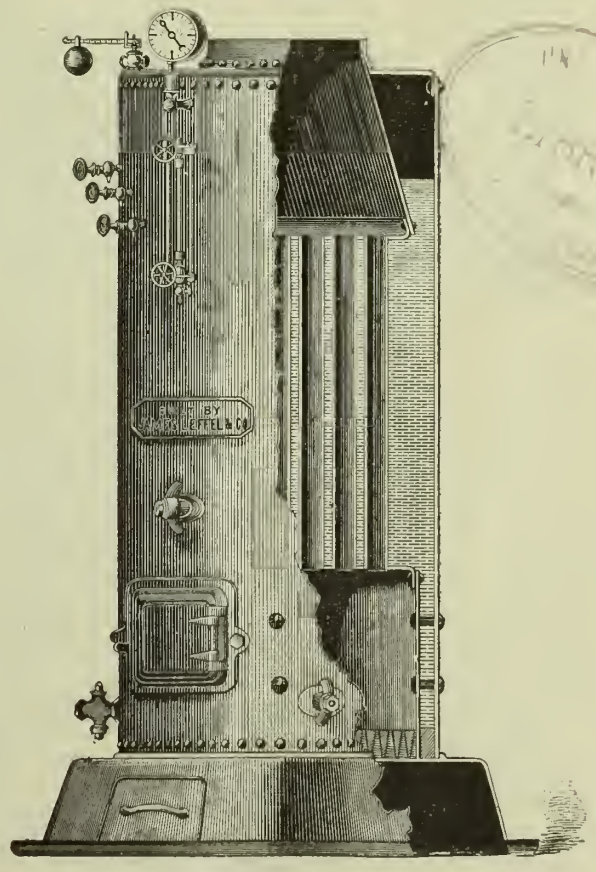


Fig. 4.

The horizontal center crank engine and self-contained return tubular boiler (Fig. 2) makes a plant which embodies in its construction many points of superior merit.

DESCRIPTION OF ENGINE.

The main frame of the engine is cast in one solid piece, and is of the class known as straight line engines, with a center crank and bearings on each side which are of more ample proportions than customary, thereby insuring greater endurance and stability. The cylinder end of the frame is turned accurately in lathe and the guides for the cross-heads are bored out in exact line with the cylinder, making a concave surface to the guides so as to insure the cross-heads from any possible binding or heating on the sides. The cross-head is constructed with adjustable gum-metal gibs or followers. The cross-head with its pin and connecting rod, as also the crank shaft, are made of pure homogeneous solid cast steel. The cylinders are cast of carefully mixed iron so as to insure the best results in regard to tenacity and density, as are also the pistons and valves. The cylinders are covered with asbestos with Russia iron jacket having brass band trimmings. The well-established "D" slide valve is used of proper proportions adapted to the surface and speed of the engines. The eccentric for operating the valve being arranged to fasten in position with a cap screw, having two holes for set screw in web of eccentric, so that by changing the screw from one hole to the other the engine is adjusted to run in the opposite direction.

DESCRIPTION OF BOILER.

The boiler is of the class or style known as the Cornish return tubular boiler, the same as are almost universally used on ocean steamers, which is a positive guarantee of their safety and efficiency, as Messrs. Leffel & Co. remark, for of all places in the world where the absolutely best boiler is required it is for that purpose. In this construction of boiler the fire box consists of a large cylindrical flue surrounded by water, extending the entire length of the boiler, in the front end of which is placed the furnace with the bridge wall at back end of the grates, which are of unusual length, making a long furnace and ample grate surface, which will be appreciated by engineers, particularly when wood is used for fuel. Back of the bridge wall is a combustion chamber the entire diameter of the furnace flue, its rear end having a chamber extending upward for the return of the heated gases

through a series of best quality of lap-welded tubes, the length and diameter of tubes being properly proportioned to the size of the boiler. The rear end of the boiler is constructed with door for the ready inspection and cleaning of that portion of the boiler; this part having a special improved patented fire-proof lining which protects

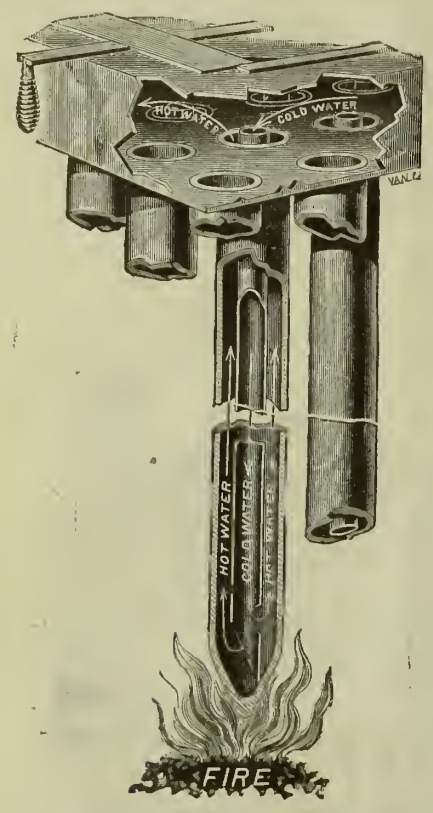


FIG. B2,–PENDANT PIPE

the head and retains the heat within the combustion chamber. The front end of the boiler has the furnace fitted with substantial double plate hinged door and also hinged doors for the ash pit and the smoke bonnet, the latter of which can be readily opened by turning a button, and free access is had for the purpose of cleaning or examination of all the tubes. The entire boiler is constructed of steel, and in obtaining one of these boilers the purchaser can rest assured of procuring the very best article of the kind at present manufactured, as the manufacturers guarantee.

THE IMPROVED UPRIGHT ENGINE AND BOILER.

Fig. 3 shows a combined upright engine and boiler of the Leffel & Co.'s most improved design and construction. As may be observed, by looking at the cut, the engine frame is one solid casting, with main bearings and guides all in one piece, the same accurately fitted, and upper end of frame faced in lathe and cylinder attached to same. The frame is fastened to saddles which are attached separately to the boiler. The cylinder end of the frame is turned accurately in lathe and the guides for the cross-head are bored out in exact line with the cylinder, making a concave surface to the guides so as to insure the cross-head from any possible binding or heating on the sides. The cross-head is furnished with adjustable shoes on both sides fitted with gib followers, by means of which all wear on the guides can be taken up with the utmost nicety. The cylinders are cast of carefully mixed iron so as to insure the best results in regard to tenacity and density, as are also the pistons and valves. The well established "D" slide valve is used of proper proportions adapted to the surface and speed of the engines.

The boiler is built of best 60,000 pounds tensile strength steel and the upper tube sheet is dropped below the water line and an extra head put in at the top, enabling steam dome to be made cone shaped, thus giving ample steam room. The tubes are best lap-welded, and the tube holes in heads are drilled out. Each engine and boiler is fired up and carefully tested and inspected before being sent out, insuring all parts being in proper working order.

The company build this engine and boiler in three sizes, viz: 3, 4½ and 6½ horse power, illustrated pamphlet of which, replete with useful and valuable information, will be sent to all who desire it.

THE UPRIGHT STEEL BOILER.

The latest Leffel upright steel boiler, with submerged upper tube sheet, is shown by Fig. 4. It is built throughout of best open hearth homogeneous steel 60,000 pounds tensile strength, and the longitudinal seam of shell is double riveted. The entire length of the tubes and the upper tube sheet are submerged in water and the steam dome is made cone shaped, giving ample steam room. By having the tubes under water, their durability are thus greatly increased, as they are not subject to super-heating and unequal expansion. Hand holes are provided at points best adapted for the convenient cleaning of water space around fire box and crown sheet over same. These boilers are hand riveted, and the tube holes in head are drilled out and not punched.

THE BOLTON HOT WATER HEATER.

The accompanying illustrations (Figs. B1, B2, B3 and B4) speak for themselves so plainly that hardly any explanation is necessary. Fig. B1 shows a No. 25 Bolton hot water heater for extra large work. It is a double fire-pot boiler.

An advantage claimed for this construction over the ordinary "twinned" cast iron boilers is that when only one fire-pot is in use the heat may be made to pass over all the heating surface of the combined boilers, by closing the direct draft damper belonging to the fire box that is in use, leaving open the damper above the unused fire box. In order to find an outlet, the heat must therefore pass among the pipes and over the heating surfaces of the entire boiler.

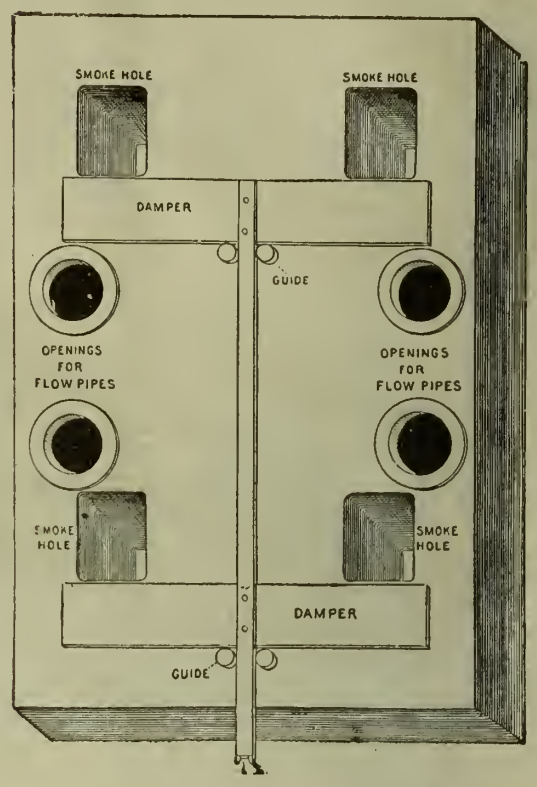


FIG. B3,–TOP OF BOLTON BOILER.

The Bolton heater has "a record." Its history shows that some good may come from Canada, for it was used in the Dominion several years before it was introduced into the United States. But after it crossed the line, it seems to have stayed. And,

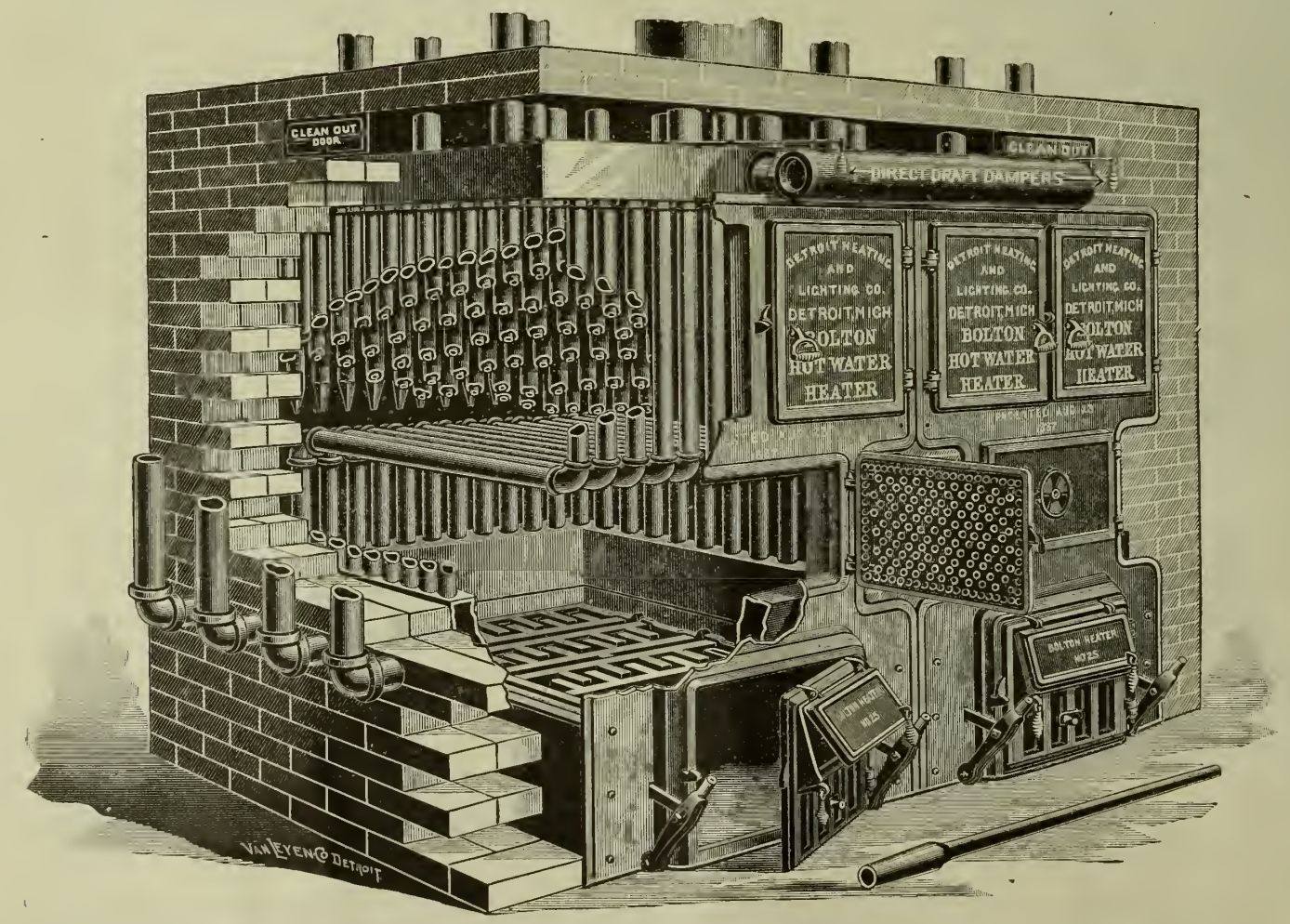


FIG. B1.

according to the testimonials of those who have used it, the Bolton has good staying qualities.

Those who are about putting up new buildings, or contemplate having a heating plant for next winter would do well to get an illustrated and descriptive catalogue, which may be obtained from the Baker & Smith Co., 83 Jackson Street, Chicago.

ENGINE FOUNDATIONS.

There ia not a detail in engine construction and operation that merits greater consideration, or is of greater importance to the successful working of an engine, than the foundation upon which it stands, says the *Tradesman*; and too much care cannot be accorded it, in order that it shall have ample spread, stiffness, unity, and adaptability to the movements and operation of the parts which it supports. It should be so bonded and tied that unequal settlement shall not take place, and the height, weight and base should be of such proportion that when the engine is in full operation there shall be no swaying or twisting of the parts, no heating of the journals, no springing or tremor of the bed arising from an unsuccessful transmission of the strains. The higher the speed and revolution, the stiffer and more solid should be the foundation, and the greater the base contact with the supporting earth. A good foundation will often decrease the defects of a poor bed, provided, of course, that such engine bed be properly and thoroughly bolted to its foundation. When properly constructed and tied together, the engine bed and its foundation should be portions of one complete whole, inseparable and undisturbed in their relationship by the movements of the engine parts while at their hardest work.

A good bottom of concrete of smooth upper surface laid upon a rock or solid earth bottom, upon which the main structure of brick is laid close and jointed with first quality of cement, and the whole capped with one or more hard blocks of stone jointed and placed to suit the engine bed, and to distribute the weight over as great an area as possible, constitutes the best foundation. Where bricks are scarce the foundation above the concrete bottom may be all of stone, and the larger the stones the better.

Ordinary rubble work is not to be relied upon, the only capacity for retaining and uniting the structure as a whole being contained in the cement. The irregular shape of the stones forming the rubble masonry present, through their lack of contact with each other, rather a precarious and unreliable bond, and the cement is too thinly laid to fix them permanently in their position, in spite of the thrust and twist of engine operation. It is far better to mould a complete foundation of concrete, capping it, if possible, with thick solid blocks already mentioned in connection with the brick foundations, the foundation completed and thoroughly set, the engine-frame or bed may be placed in position and lined up, and the joints filled and packed with melted sulphur.

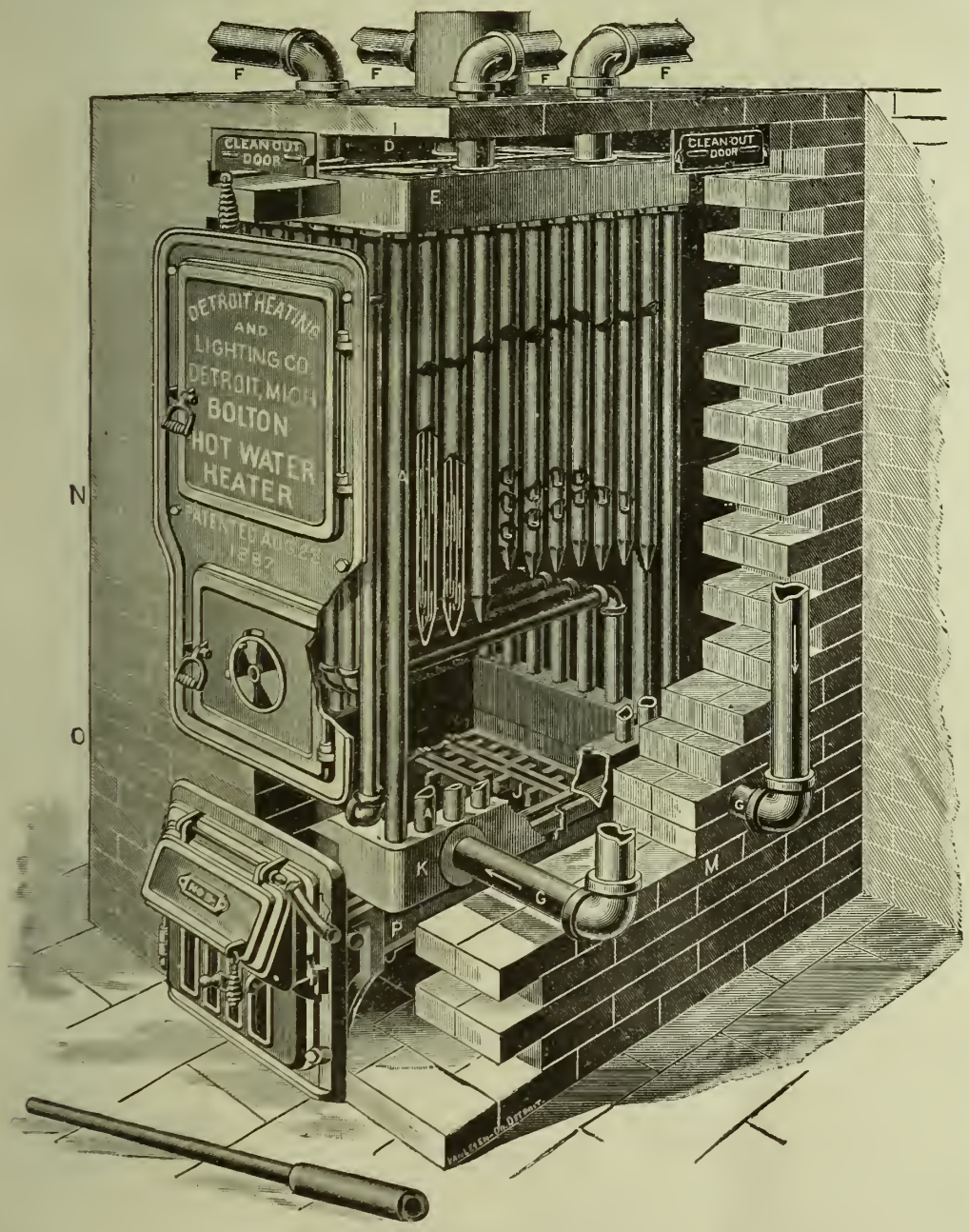


Fig. B4,-Showing Construction.

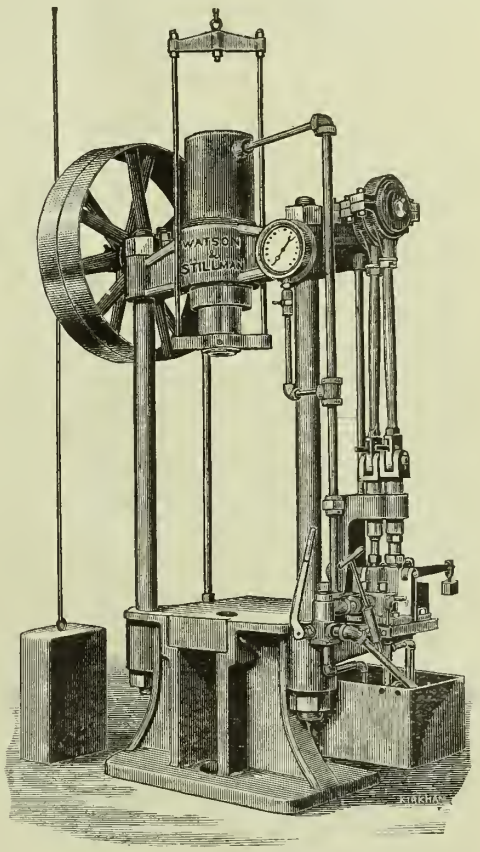
The actual nature of the soil or bottom upon which the engine and foundation is to rest, whether it be wet, soft, or elastic, whether it be dry, sandy, and solid, or whether it be a rock bottom, to which the bed may be immediately fastened with a mere leveling foundation between, determines the nature extent, and scope of the foundation, while the size, weight, and power of the engine determines its weight and bulk to prevent vibration or tremor.

Devastation by cloud bursts in Iowa has cast a gloom over the bright prospects of the Sioux City Corn Palace. Not only have many bridges been swept away, but many acres of cereals, corn and hay have been ruined. The Missouri and Mississippi rivers have risen to an unusual height, and caused great damage.

WATSON AND STILLMAN IMPROVED HYDRAULIC BROACHING PRESS.

The hydraulic broaching press illustrated by the accompanying cut (in this column) is a new and improved one, with variable delivery belt pump attached, manufactured and placed on the market by Messrs. Watson & Stillman, of East 43d street, (Nos. 204 to 210), New York City.

This press is similar in design to their plain 60-ton press with a variable delivery belt pump attached, the shaft and eccentrics being placed at the top of the press and one side of the cylinder; the shelf at the side of the lower platen. The main tension rods are 3 7-16 feet in diameter, placed in line with the center of the ram. In the bed, a square block is inserted which is bored to suit the sized shaft on which work is to be done, so that the resistance can come close to the shaft and not create any bending action upon the work, and cramping the shaft as it is forced into the hole. The opening in the bed beneath the block is carried through the base, so that in case it was desired to force long shafts out, it may be done, provided a hole is made in the floor underneath. A small handle, which is convenient, shuts off the action of the large pump, and a small lever, operating an improved form of release valve, releases the pressure from the ram, and allows it to be drawn back. In case there is any great variety of work a special block is made, which can be easily attached to the ram proper, and this, when placed in the press, shortens the clear space available. As the strain of driving the pump lies outside of the main tension rods, small ones are placed outside of the bearings of the shaft. One-third of the base lies in front of the center line of the main bolts in the 100-ton size instead of all back, as is shown in their 60-ton form. One of their safety couplings protects the guage from injury by the sudden releasing of the pressure.



Improved Hydraulic Broaching Press.

These tools are in use by a great number of first-class houses, such as the Brown & Sharpe Manufacturing Co , Pratt & Whitney, Hendey Machine Co., Lodge & Davis Machine Tool Co., etc.

Chicago people are proud of their weather. Visitors in 1893 will be so delighted with the state of the atmosphere on the South-eastern border of Lake Michigan, they think, that they will forever after make the "Windy City" their summer resort. The population of Chicago is increasing rapidly, and this metropolis of the west is expected to surpass the Empire City, by which title New York is usually designated, and that in the near future. And the marginal difference of population is small.

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JEFFERSON YOUNG, JR.
Supreme Chief Engineer A. O. of S. E.

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CONTENTS OF THIS NUMBER.

DELEGATES to the meeting of the Supreme Council, at Syracuse, N. Y., will be on their way, or preparing to start, by the time our next issue will be published. The Supreme Chief Engineer invites them to go to church in a body, on Sunday evening, to put them in a good state of mind for the business and pleasures of the coming week. This is somewhat reversing the Shakesperean order, for the American Order of Steam Engineers seem to put greater stress on a good beginning rather than merely saying, "All's well that ends well." They will begin well, and trust to Providence to bring them to a good end.

CONTRIBUTIONS to the Harry Hohn Fund materialize somewhat slowly. Many have intimated that they are going to contribute. But the names of those who have "done it" are not yet numerous. In a case of this kind delays have a tendency to lead to forgetfulness. But we hope this case will not be thrown on the shelf. Three new contributors appear in this issue, aggregating $20. And we would call special attention to a communication from the treasurer of this fund, Mr. Franklin R. Moore, who states that some make checks and money orders payable to others. All contributions to this fund should be made payable to Mr. Moore.

FOR THE BENEFIT OF THE GRAND COUNCIL OF PENNSYLVANIA.

KENSINGTON VS. SOUTHWARK.

There will be an excursion of all the councils in and about Philadelphia to Brandywine Springs, on Saturday, August 1st. This is a splendid place. There is a large pavilion to dance in, with theater and baseball ground.

Kensington Council has challenged Southwark Council to a game of baseball on the day mentioned, and we are looking forward to a good time, when with our wives and children we may spend a day of real pleasure. Bro. Hugh Gorman and the Committee on Good of the Order have charge of the matter.

I will be sure to send the result of this game of baseball to the AMERICAN ENGINEER. It will be the feature of the excursion. Some of the boys have already gone into training for the event. Fraternally, JAMES LIGHTROOT, Cor. Engr. Kensington Council, No. 3, A. O. S. E.

FIXED HYDRO-CARBON OIL ENGINE.

The prominent novelty of the Bath and West of England Show at Bath, says *Iron*, is unquestionably the fixed hydro-carbon oil engine of Messrs. E. Griffin & Co., Kingston Ironworks, Bath, and which engine we purpose shortly to illustrate and describe in detail. This engine is the most recent invention of Mr. S. Griffin, the patentee of the well-known Griffin gas engine, and has just been designed with a view to the highest possible efficiency, combined with simplicity, both in operation and mechanical detail. Its present development is due to a long series of careful experiments, in which every element of uncertainty or complication has (as far as possible) been traced and removed, these results being further established by the long practical experience which Mr. Griffin has had in the working out of this class of motor. The engine is of the horizontal type, resembling in general appearance, an ordinary single-acting Griffin gas engine, having, however, in addition, an air pump, an air reservoir, a petroleum reservoir, and a vaporising apparatus. The details for operating, governing, and igniting the working charge are entirely novel. The completely-successful performance of the engine, both from a mechanical as well as an economical point of view, bear the fullest testimony to the soundness of the principles employed. The petroleum is contained in a tank placed in the base of the engine, holding a sufficient supply for a day's full work. A special advantage in this arrangement, however, is that the petroleum not being under pressure, the tank can be recharged at any time while the engine is working. This is a most important practical advantage. The petroleum passes from this tank by a small pipe to the spraying apparatus, where, by means of a special jet, it is converted into fine spray, and afterwards vaporised. The spraying apparatus is of very simple conctruction, having no tendency to become deranged in working, and can be inspected in a moment while the engine is running. The governing apparatus embodies an entirely new principle, by means of which a most perfect control of the motion is maintained, while the highest possible economy is said to be effected. The movement both of the inlet as well as the exhaust valves, is dependent on the governor, by means of which their motion is rendered continuous or intermittent, according to the load on the engine. When running light, the engine may make as many as twenty revolutions, between two impulses, there being no movement of any valve during the whole of these revolutions, while the piston during the same time is relieved of all the negative work of charging and exhausting the cylinder. It will thus be seen that, while wear and tear is greatly reduced, economy in light and intermittent running is proportionately improved. The low working temperature of the cylinder, due to the same cause, not only largely reduces the amount of jacket water required, but also proportionately increases net efficiency by largely reducing internal friction, and wear and tear. The igniting apparatus is of simple description, and by its means a small quantity of petroleum is intimately mixed with a proportion of atmospheric air, and caused to impinge on a small incandescent ignition tube, absolutely reliable ignition being obtained. The igniting apparatus, it is said, does not consume more than one pint of petroleum for a working day of ten hours, while the combustion is so perfect that nothing but a small blue flame is visible, and this is absolutely free from all smell, or unconsumed vapour. From our inspection of this engine we cannot resist the conclusion that it is a simple, reliable, and economical motor, free from danger, ready for use at five minutes' notice, and suitable for every kind of work, in any climate.

COMPOUND AND PLAIN ENGINES.

The compound and triple expansion engines are certainly economical in the amount of coal that is required to run the boilers by which they are furnished with steam. A plain non-condensing engine requires thirty pounds of water converted into steam, the boiler being at ninety pounds pressure, to give one horse power. A compound condensing engine requires twenty pounds of water converted into steam, the boiler being at from 125 to 140 pounds pressure, to give one horse power. Thus it will be seen that to run the compound condensing engine requires one-third less fuel to obtain one horse power than is required to obtain one horse power with a plain non-condensing engine, which is a saving in the cost of coal of 25 to 30 per cent.

With a triple expansion engine it requires thirteen pounds of water converted into steam, the boiler being at 175 to 200 pounds pressure, to obtain one horse power.

Doubling the pressure in the boiler with one-third more coal doubles the power obtained from the engine. Thus it will be seen that the power obtained is greater in proportion than the extra amount of coal used to increase the pressure of the steam in the boiler.

This saving in the coal bills by the use of compound and tripple expansion engines is coming to be appreciated.

Although there is a saving in fuel obtained from the use of compound engines, etc., there is an advantage in their use only in large plants, as it does not pay to put in a compound engine of only 100 to 150 horse power. Compound and triple expansion engines range in power from 250 horse power up.

As regards the high pressure of steam carried by boilers for compound, triple expansion and quadruple expansion engines, it may be said that a tubular boiler cannot be employed, as the risk of explosion is too great, and that a sectional boiler must be used. The great advantage of a sectional boiler is its practical freedom from risk of explosion, as if one section is over-taxed the boiler is not destroyed. This is an important item and well-known to all users of compound, triple expansion or quadruple expansion engines across the water.

High pressure boilers are tested for two pressures; a testing pressure and a working pressure. The testing pressure is the capacity of the boiler for carrying safely a maximum amount of steam, and the working pressure is the pressure at which the boiler is supposed to be run in actual service. The testing pressure is always made at the boiler manufacturer's works before being sent out and is one-third greater than the working pressure.

To a small manufacturer running a tubular boiler and a plain non-condensing engine, the high pressure at which some of the boilers in Europe are run is a revelation. For instance, the London Electrical Supply Corporation (Limited), of Deptford, runs five boilers, whose testing pressure is 300 pounds each, and whose working pressure is 200 pounds. Some of the boilers are very large, being 1500 horse power. There is also in use at the works of Alexander Turnbull & Co., engineers, Bishopbriggs, Glasgow, a 51 horse power boiler with a testing capacity of 300 pounds.

These concerns using these high-pressure boilers and triple expansion and quadruple expansion engines effect great savings in their coal bills, which are enormous anyway, and if they were put in low pressure boilers and plain non-condensing engines, their books could but show a considerable falling off in profits. All through England, the Continent, India and Canada, these high-pressure boilers are used, and their general introduction into the United States is but a matter of time.

ELECTRICITY.

Dynamo tenders and superintendents of electric light or electric power circuits have sprung up numerously, all during the past decade, and electrical industries have assumed vast proportions.

Several of our subscribers are already in charge of electric machines; and a great number expect to be, in the near future. The latter, who are not yet "in it," are uncommonly anxious to know "all about it." Many of them have a vague idea that expert electricians know exactly what electricity is, and are complete masters of it. This, however, is a great mistake. No one knows what electricity really is. Those who know most about it, do not pretend to know what it is. And, as Prof. Houston says, in his Electrical Dictionary, electrical science has now advanced sufficiently far to recognize the fact that the exact nature of electricity is not known.

For all that, there is much to be known, in order to enable one to furnish light or power by means of electricity. And the more one knows of the laws of electrical science, he is all the better fitted to even attend a dynamo, if nothing more. And we propose, in these columns, to impart as much information as possible in the way that will be most likely to help those who are anxious to learn as much as they can concerning the application of electricity for the service of man, especially for electric light and electric power.

If those interested will follow us closely, and make a few experiments (which may be done at a trifling cost) in the way we may point out, as we proceed, they may derive great benefit therefrom. One man, by himself, in a little place at home, or perhaps in his engine room, may educate himself in this way to an extent that will amaze him.

A few joining together, as a club or class, would be a far better plan, as a number could help each other and create enthusiasm. But the best plan of all would be for the councils of the American Order of Steam Engineers to have "electrical nights," and make electrical science a special study. A number of first-class electricians, with whom we have communicated on the subject, have expressed their willingness to give instruction, experimentally and otherwise, if such councils choose to enter upon such a course of study as we have indicated.

Then again, those who have been "through the mill," and have learnt to run electric machines and operate light or power circuits, can furnish interesting facts, if they be generous enough to relate their experience for the benefit of others. It is in this way that electrical science has been advanced so far as it has. One man has fallen upon this discovery, another upon that, and by comparing notes much progress has been made. For, although no one knows what electricity really is, electrical students and inventors have noticed that by doing certain things there would be certain results. And some important discoveries have been made quite accidentally. For instance, a careless workman, at the Vienna Universal Exposition, found some wires trailing along the ground which belonged, as he supposed, to a Gramme generator that was not then running, and he fastened the ends of those wires in the terminals of that machine, when, to his utter amazement, the machine revolved rapidly. Upon investigation it was ascertained that the wires which the man had picked up, and connected to the dynamo that was not running (until the wires were fastened thereto), belonged to another electric machine, that was in operation, some distance off. Just in what way it was discovered that one electric machine would work another, while a considerable distance apart, and that was the beginning of the application of electrical power, or the transmission of energy by means of the electric current. And to-day electric generators supply electricity, or what is commonly called electric power, from a central station to almost any distance required, and for any purpose that may be desired. Sewing machines, church organs, passenger elevators, mining machinery, and other devices requiring energy to operate them, obtain all that is necessary by the electric current.

Theories have helped investigators and students considerably. And before proceeding with the practical side of the matter, we will briefly state what are the leading theories that have been advanced, at different times, to try to explain electrical phenomena, or the result of electrical applications.

I.—PULSES OR WAVES.

Advocates of the wave theory, to account for what is called electricity, think that waves of force penetrate substances just as sound waves pass through the air, and that what is generally called electric current is only a motion of the force waves. Dr. J. Solis Cohen, gives some extremely interesting explanations of various forms of motion as follows:—

"The peculiar form of motion which gives rise to the sensation of sound is that form known as oscillation or vibration; a motion that repeats itself at regular intervals,—a motion to and fro, up and down, forward and backward,—the motion of a pendulum, of the balance-wheel of a watch, of the strokes of a trip-hammer, of a ball kept tossing in the air, etc. The effect upon the air is to produce alternate condensation and rarefaction in spherical waves or undulations, radiating from the centre of disturbance. When this sort of motion is not excessively rapid, that is to say, when it recurs less frequently than sixteen repetitions in the second of time, it is too sluggish to rouse the organ of hearing, and produces merely some of the ordinary manifestations of mechanical force, as we see in the industrial arts. But when it is more frequent than sixteen times per second, there is special manifestation of sound, whatever the physical work that may be going on; and the pitch, intonation, or acuteness of the sound rises in direct proportion to the increased frequency of the motion (like the musical whiz of a steam saw, when sawing lumber, for example), until at the rate of from thirty thousand to forty thousand repetitions per second, the effect becomes so shrill and sharp as gradually to transcend human power of hearing it; when all sound ceases, and our ears are silent to the increased motion. There is abundant evidence, however, to show that vibrations even still more rapid can be heard by insects and other animals. The physical reason that such rapid vibrations fail to impress the organ of hearing, is probably due to the fact that they are too rapid for the weight or density of the nerve fibres to respond to, and that before these fibres have time to recover, as it were, from the forward motion of one oscillation, the others come on behind with such rapidity as to keep the nerve fibre pressed still, or dampened, as it were, so that it has no opportunity to vibrate, and is consequently silent.

"Away beyond the limits of audition (or hearing) among vibrations the rapidity of which we cannot realize, amounting to tens of millions per second, the special physical manifestation is perceived as ELECTRICITY; and far beyond the limits of electric excitation, where the motion begins to be executed in hundred of millions of vibrations per second, the manifestation of the motion is heat; and when the frequency of vibration amounts to several hundreds of millions per second, the manifestation is light; and beyond the limits of light, the motions produce those still occult forces of decomposition and recomposition known as chemical action. Hence chemical action, light, heat, electricity, sound, and mechanical force are all manifestations of one universal force—*motion*. As these manifestations are, to a certain extent, convertible one into another, we are led to the comprehension of a grand fundamental principle of science known as *the correlation of forces*.

"Strike a match,—one of the most wonderful inventions of human ingenuity, by the way,—and you may demonstrate several of these points at one stroke; a trite experiment, it is true, but striking and brilliant, both literally and intellectually. The friction—*mechanical force*—develops a rapid vibration of the air around the head of the match, producing one kind of *sound*, while the explosion produces another; *heat* is communicated to the wood of the body of the match, which becomes warm to the fingers that hold it; *light* is produced by the explosion and subsequent ignition of the match, and the wood burns; and *chemical action* results, as evinced by the cloud of phosphoric acid, and the oxidization of the hydro-carbon of the burning wood; while, furthermore, the presence of *electricity*, always generated in chemical action, might be demonstrated were an electroscope or electrometer in proper connection with the match. Here, then, we have a variety of motions excited, illustrating the entire series of forces.

"Rapid vibrations (at a rate exceeding sixteen per second), then produce a peculiar effect, which excites that special sensation which is termed sound. At this rate of sixteen vibrations per second, the sound is a low rumble, which almost admits of perception of the coalescence of the sixteen vibrations into a deep tone, as in the sound from the longest organ pipe, which is thirty-two feet in length, and is tuned to C^2 of $16\frac{1}{2}$ vibrations per second.

"The more rapid the vibrations, *the higher in pitch* becomes the sound. * * * The influence of the pitch of a sound in exciting a silent instrument attuned to the same pitch is well known to musicians. The response of a glass gas-globe to certain tones of the voice, for example, or the rattling of a pane of glass from a similar cause, must be familiar to all. The waves of sound set up in the first instance are powerful enough to start the vibration of the responding body. The effect is mechanical altogether. It is similar to the effect of rhythmic vibration of a suspended bridge which may accumulate force enough to throw it down. Hence marching in time is prohibited upon suspension bridges. There is an old saying that a bridge of this kind could be destroyed by continuously fiddling on a note of the same pitch as that of the bridge, from mere accumulation of force in the sonorous waves. Heavy bells are started by commencing with gentle impulses in rythmic accord with the proper oscillation of the bell."

To quote from "Middlemarch," Chap. XXX.:

> "How will you know the pitch of that great bell
> Too large for you to stir? Let but a flute
> Play 'neath the fine-mixed metal! Listen close
> Till the right note flows forth, a silvery rill:
> Then shall the huge bell tremble—then the mass
> With myriad waves concurrent shall repsond
> In low, soft unison."

It was an application of this law, in all probability, that destroyed Jericho. Trains going over the suspension bridge at Niagara Falls are obliged to proceed very slowly, or else they would start such waves of vibration in the structure that would destroy it in short order. Street cars and carriages are obliged to pass over Chicago's numerous bridges at a comparatively slow pace. Few of the drivers, or even the bridge-tenders, know the main reason why. But the chief engineers know that, although these are not exactly suspension bridges, yet the law of vibration and wave force would soon exert itself if their "music" was once set agoing; and if *electrified* in that way they would fall as surely as the walls of Jericho fell. We know, of course, that past theologians ridicule the idea that Jericho's walls fell in accordance with natural laws. Even such a famous commentator as Dr. Adam Clarke, who flourished the very first part of this century, says; "There has been much learned labor spent to prove that the shouting of the people might be the natural cause that the wall fell down. To wait here, either to detail or refute any such arguments, would be lost time; enow of them may be seen in Scheuchzer. * * * The blowing of the trumpets and the shouting of the people, were too contemptible to be used even as instruments in this work, with the expectation of accomplishing it in a *natural* way."

Now, what did occur, according to the accepted narrative? When Joshua was by Jericho, he was confronted by a strange visitor (sent from God in some way) who told him what to do in order to take the city. And following these instructions, the seven priests blew their jubilee trumpets, which were made out of rams' horns, before the strange visitor, who gave directions how to act, and no doubt explained what pitch to blow in (else why experiment before the Lord—in the person of the stranger who had come "as captain of the host of the Lord"). The city was a small one, and it was surrounded by a host of nearly 600,000 fighting men, beside from two to three millions of people that were with them. It was only the military portion of the invaders that marched around the city, probably. "And Joshua had commanded the people, saying, Ye shall not shout, nor make any noise with your voice, neither shall any word proceed out of your mouth, until the day I bid you shout;

then shall ye shout"—with a vengeance, so to speak. But the priests "went on continually, and blew with the trumpets." This was done early for six consecutive mornings. The sound of the trumpets and the tramp of about 600,000 soldiers, thus regularly, brought the walls of the city into tune, so to speak, and set their particles (harmonized in that way) in motion, and set up a powerful current. The host of people had also become habituated to the continuous sound of the trumpets, and their voices had become *pitched* accordingly. By the seventh morning, the sound of the trumpets had brought the vibrations set up in "the walls" into a pitch ready to receive the great force of motion that subsequently came from the people's throats.

"And it came to pass on the seventh day, that they rose early about the dawning of the day and compassed the city after the same manner seven times, only on that day they compassed the city seven times. And it came to pass at the seventh time, when the priests blew with the trumpets, Joshua said unto the people, Shout; for the Lord hath given you the city."

This latter expression may sound a little strange, and may be ridiculed by our friend Col. Robt. G. Ingersoll. But it is a common expression even in these days. For instance, when the last Republican National Convention was held in Chicago, the nominator of Michigan's candidate (Col. Alger) declared the choice was from the Lord. The advocates of Judge Walter Q. Gresham for the presidency also declared that God Almighty was guiding them, and that the divine guidance, combined with the tin-pail brigade, would lead them to victory sure. This assertion of Joshua is commonplace enough when we take a broad view of it. Even the modern politician knows that human events are decided upon in heaven, and that the Most High, throughout all the ages, lifts up one and puts down another—carrying out the divine purposes by pressing on the springs of human action. Those ambitious men, who remember that fact, take their defect as gracefully as possible.

But, to return to Jericho. "And it came to pass, when the people heard the sound of the trumpet, and the people shouted with a great shout, that the wall fell down flat." In other words, the people, when the right time had come, listened attentively to the sound of the trumpets, and, pitching their voices in accord therewith, shouted as loudly as possible, and thereby set up such a wave of force that increased the vibrations that had been gradually set up in the walls so that they fell. That is, some portions fell, so as to open the way for the hosts of Israel, to enter in. It is evident that the whole walls did not fall. Rahab, the harlot's house was "on the wall" somewhere, and a line of scarlet thread hanging out of her window signified the portion that was not to be attacked unto destruction. The shouting was done against some other section.

The Scriptures do not inform us how the walls of Jericho were constructed, or of what material, which is important to know from an electrical standpoint. The Targum intimates that the place was very strong, having "gates of iron, and bars of brass." The inhabitants evidently considered themselves perfectly safe within such gates and behind such bars; just as the builders of Chicago's "sky scrapers" have every confidence in pillars and beams of thoroughly tested steel.

But while the iron gates and the brass bars of the "City of the moon" (Jericho) could not be battered down by ordinary means, perhaps, yet the subtle power of electrical energy, or wave force, brought them to the ground—"flat." And if Dr. Adam Clarke had lived to-day when the knowledge of electricity is being revived, he might not have pooh-poohed the blowing of trumpets and systematic shouts of the throng. The whole proceeding was designed for a purpose. And if the surmise is correct, that the blowing of the trumpets brought the vibrations in the walls (or some part of them) and the vibration of the assailants' vocal bands into the same pitch, whereby the shouting increased the vibrations in the wall so that it fell, then the wave theory of electrical development is well founded.

The rapid transit idea, which we published in a recent issue, is adhered to by the inventor, and we will publish a letter from him next week.

STEAM ENGINE INDICATORS.

In expressing its disappointment in reference to Prof. Perry's indicator, our British contemporary, the *Mechanical World*, says:

The errors incident to the ordinary forms of steam engine indicators have frequently been discussed both at the meetings of the engineering societies and in many of the technical journals of this country and America. Laudable attempts have been made to diminish such of the errors as arise from superfluous weight and imperfect workmanship, the chief improvements effected in this direction being due to the spirited rivalry between two or three leading American manufacturers. The result is, that many of the instruments obtainable at the present time appear to be as nearly perfett as it is possible to conceive, so long as the present construction is retained. The springs are made as short as due regard to uniform yielding will permit; while the pistons and pencil motions are certainly of the lightest possible proportions. Probably the only way in which a still further reduction in the weight os lhe reciprocating parts can be effected is by the substitution of aluminium fyr the metals now generally employed. The remarkably low specific gravity of this metal might be well taken advantage of in the construction of the moving parts of the steam indicator; but though its use has been repeatedly advocated, no serious attempt appears to have been made to put the suggestion into practice. Attempts to improve this valuable instrument have not, however, been entirely restricted to the simplification of the pencil motion and the reduction of weight. More than one ingenious method of overcoming the effects of inertia, etc., has been proposed, among which we may mention the indicator of Prof. J. Burkitt Webb, described in a paper read before the American Society of Mechanical Engineers in 1884. In this arrangement the diagram was described in successive sections, the vertical movement of the piston, while describing each, being very small. A complete diagram could thus be obtained when the engine had made a few revolutions, and assuming the load and other conditions remained constant during that time, a very accurate diagram was obtained, which, of course, really consisted of portions of a series of diagrams. Other proposals of a similar character have been made from time to time, most of which exhibit considerable ingenuity, and are invariably interesting studies. When, therefore, it was announced that Prof. Perry, of the Finsbury College, had devised an indicator capable of being employed for all speeds up to 2,000 revolutions per minute, we not unnaturally anticipate another manifestation of the professor's inventive faculty which he has exhibited in many instances. In point of fact we expected a novel and practical attempt to overcome the defects of the ordinary indicator, and we may at once say that Professor Perry has disappointed us. In the first place, the idea is not by any means new; in the second place, the instrument is quite unfit for everyday use in the engine room; and in the third place, its construction appears likely to introduce errors as serious as those inherent in the ordinary instrument. In place of the usual cylinder and piston, a small circular disc of thin steel is fixed around the edge, and is exposed on one side to the steam pressure. Attached to the disc, about half way between the center and the circumference, is a small mirror, upon which a ray of light is arranged to fall, the reflected ray being received upon a vertical screen. It is easy to see that any variation in the steam pressure will cause a change to take place in the position of the small disc, and the position of the refleted ray will vary accordingly. This corresponds to the vertical movement of the ordinary indicator pencil. To imitate the movement of the paper-carrying drum, the whole instrument is given an angular movement in a direction at right angles to that in which the disc moves. The result is that a diagram is traced upon the screen and may be photographed or traced with a pencil. As to the novelty of this arrangement, we may say that more than six years ago, a practically identical device was described in an American contemporary, from which description the following is taken:—"An indicator has been devised by F. M. Clark and F. R. Low, of the 'Boston Journal of Commerce, which is an entire departure from the former ideas and principles, the only portion of which that receives any appreciable movement is a beam of light, and this, being without weight, may receive any desired movement without effect from momentum or inertia. The indicator is attached by a coupling to an ordinary indicator cock, and consists of a cup-shaped receptacle, which is closed steam tight by a stiff diaphragm, which is of a fine quality of tempered spring steel. Above the center of the diaphragm is a small mirror, hung upon a spring pivot in such a manner that it is tilted by the slight movement which the diaphragm undergoes under the varying pressures to which it is subjected in the working of the engine, in such a manner as to cause a beam of light reflected from it to trace a vertical line on a screen upon which it may be thrown. A pin upon an arm is attached to a reducing motion and receives a movement not to exceed half an inch. Upon this arm is carried the bridge which supports the mirror, and the motion thus given to it will cause the beam of light to trace a horizontal line at right angles to the line caused by the motion of the diaphragm. The vertical motion corresponds with the up-and-down movement of the pencil of an ordinary indicator, while the horizontal motion is that of the paper drum, and it will be seen that the combination of these two motions causes the beam of light to trace upon the screen a diagram of energy after the manner of the ordinary indicator card." Trials were made with the reflecting indicator, but the obvious difficulties attending the use of such an arrangement have apparently prevented its adoption. We suppose that Professor Perry would use discs of various thicknesses in place of springs of different strengths; but in any case such an instrument, with its accompanying paraphernalia of screens and oil lamp, will not find favor with practical engineers, while the possible errors liable to occur in attempting to follow the line of light with a pencil, will probably nulify the slight superiority which the instrument is suppoted to possess over those of ordinary construction.

THE SHIP OF THE FUTURE.

It is common experience with ship-owners and ship-builders to have propounded to them means whereby even thirty knots per hour may be realized, and these backed up by very elaborate calculations as proof, but which, when investigated, are found, like those of a well-known writer of scientific romance, to be wanting in some little detail, in significant at first sight, but absolutely essential to complete the proof. So far no great departure from the existing form of ship, nor from the method of propulsion, has resulted in obtaining a higher speed than is common with ordinary ships of the same dimensions; and in nearly every case such departures have mortified the inventors as well as disappointed the public by turning out absolute failures; and there is no good reason to suppose that further successes than have already been attained will be achieved in any other way than by improving the conditions that now obtain, both as regards form of ship and method of propulsion, inasmuch as the physical causes which combine to retard the motion of a vessel, and the physical forces which are employed in overcoming that resistance, remain to-day as they ever were, and are —in fact, Nature's immutable laws. The commercial question is also one that presses very hardly at all times and must continue to do so more and more, as will be seen later on. The Atlantic greyhound of to-day is, in immersed form, substantially that of the viking's craft of more than a thousand years ago; and if we look to Nature for our study we shall find that the swiftest fish are not unlike in general form to the submerged part of a ship; and the comparison is the more easily accepted when it is remembered that the fish is wholly submerged while the ship is only partially so, The one has to contend with waves and other surface disturbances, and must perforce keep above the water, while the other is free from such disturbing elements and conditions, and pursues its course in practically smooth water.—From "Speed in Ocean Steamers," by A. E. Seaton, in July *Scribner*.

A great revolution is about to take place, says an engineer, in the art of printing. More anon.

CORRESPONDENCE.

Multnomah Council (No. 1, Ore.) Progressing.

To the Editor of the American Engineer:

Sir:—The ablest engineers of this city of Portland, Oregon, feel happy in the thought that they now have the honor of belonging to the American Order of Steam Engineers, as members of Multnomah Council. The name is indicative of good standing and ability. And its members and officers are educated men and competent engineers, having ability to step into any position with honor to themselves and credit to their employers.

Brother Henry Coates, the Deputy Supreme Chief Engineer of Oregon, notified the twenty charter members of Multnomah Council that a meeting would be held June 14, in the G. A. R. hall to elect officers, etc. The D. S. C. opened the meeting with an able address, after which he conferred the obligation upon those present. The Council then proceeded to elect officers, as follows:

Past chief engineer, W. P. Fought.
Jr. past chief engineer, D. E. Welsh.
Chief engineer, J. C. Cunningham.
First assistant engineer, M. W. Ingalls.
Recording engineer, B. S. Castell.
Corresponding engineer, W. E. Harris.
Financial engineer, James Gill.
Treasurer, M. F. Coberth.
Chaplain, R. Uhlman.
Senior master mechanic, Chas. Tranes.
Junior master mechanic, Wm. T. Smith.
Inside sentinel, Wm. T. Hutton.
Outside sentinel, Geo. Hawkins.

Trustees: S. Gill, J. C. Hamilton, James Gill E. Davis, W. E. Harris, M. F. Colberth, and W. T. Smith.

After election of officers, it was decided that this Council meet every week. When the question of securing a hall came up, each member volunteered to act as "a committee of one" to look out for a hall and report at the next Council meeting.

It was evident during the proceedings, that the members of this council have no intention to flush its membership list with quantity; they prefer to go slow, and maintain quality and ability. The principal power plants in Portland are now represented in Multnomah Council; and, without flattery, the Supreme Council may well feel proud of their first council in Oregon. Our prospects are bright. And you shall hear from us often.

Our members extend to each other that fraternal spirit which should exist in bodies of this kind. Intelligence is the prime factor. And we hope that great success will crown our efforts in the good cause.

W. E. Harris, Corresponding Engineer.

Buckeye Council, No. 4, Canton, Ohio.

To the Editor of the American Engineer:

Sir:—Buckeye Council is in good condition, and we are having some interesting meetings; plain talks on the engine and indicator, with lively discussions thereon, are of frequent occurrence. And then, once in a while, we think of that bill of fish from Bro. Morgan, who used to be somewhere in Northern Michigan. If this comes to the notice of the brother, will he please let us know where he is? We have rather lost track of him.

Brother Slusser, who received almost fatal injuries from the electric current, is all O. K. again. Fraternally yours, G. E. Miller, Cor. Engr.

The Akron Boiler Explosion.

To the Editor of the American Engineer:

Sir:—A boiler exploded at noon, June 18, just west of the Water Works Co.'s pumping station, killing one man, fatally injuring one, and five others badly hurt.

It was used where a number of wells were being put down for the Water Works Company and was an old shell, portable, and had been declared unsafe by experts.

The engineer in charge was accustomed to use extra weights on the safety valve, claiming it was the only way the necessary amount of steam could be kept up, and often the gauge showed as high as 140 lbs., which was the pressure at the time of the explosion.

The terrific force of the explosion is evidenced by the scene, the heaviest parts being found 500 feet away, and there is a complete wreck of everything else. It was learned that the manager had placed two men at the scene of the wreck to misinform the people. It was a poor plan. Yet, thus far, no particular investigation has been ordered. An attempt is being made to rush the matter up. The exact cause is plain enough—an old boiler and high pressure, and being in charge of an incompetent engineer.

Space will not permit a more lengthly report, but you have the exact particulars in brief. Yours very truly, D. W. Gammell.

Akron Council, No. 5, Ohio.

The Cleveland *News* and *Herald* had the following report of the event, under the caption of "Frightful Explosion":—

A boiler exploded this forenoon just west of the pumping station of the Akron Waterworks Company, on Wooster avenue, where the Cook Company, of St. Louis, have been putting down a number of wells for the waterworks company. An old boiler has been used which had been several times declared unsafe by experts. At the time noted a number of employes at the Akron street car barns on Wooster avenue were startled by a violent shock. Looking in the direction of the drilling party they were horrified to behold the entire drilling apparatus rise seventy-five feet into the air, mingled with the bodies of several men. Hurrying to the scene a sickening sight presented itself. The bodies of two men were found lying still in pools of blood. A few feet from where the engine had stood lay the body of Henry Golden, the engineer at the waterworks station. They endeavored to raise him but his head fell backward. It was held to the body by a small strip of flesh.

They next turned to John Harvey, who was lying a few feet away. He could scarcely be recognized. His eyes had been blown out, while over his face the steam had left a mask of dead white flesh. At his home Dr. Sweitzer's examination developed the fact that, in addition to the injuries to his head, the fore part of his body was so badly scalded that the flesh came off with his clothes. His left knee is terribly shattered and his recovery is impossible. Clarence Felton, a single man, living on Wolf street, was badly scalded about the back and was severely bruised by falling timbers. Newton Ramey, of Ontario street, was struck on the head by a flying timber and severely scalded about the back. James F. Mason was considerably bruised and his left foot was badly cut and broken. James Faraber was blown 125 feet into the field, but with the exception of a few slight bruises and scalds he was not injured to speak of. Benjamin Huffman is seriously scalded about the head, eyes and arms.

The scene at Golden's home was a pitiful one indeed. When Mrs. Golden was notified of the fate of her husband she cried out, "O, why did he go?" The little children clung about her and sobbed as if their little hearts would break. Golden was only a visitor to the scene. He was terribly injured a year ago by a street car, and he said that if he was ever injured again he hoped he would be killed outright. He leaves a wife and six children.

The terrific force of the explosion is evidenced by the scene. The body of the boiler, weighing 3,000 pounds, was found 500 feet from where it had stood, and had cut its way through trees at that. The tool boxes and portions of the engine were found hundreds of feet away and the wood was reduced to splinters.

How the accident occurred is not known, except that the steam ran up rapidly just before the explosion.

THE SUPREME COUNCIL MEETING.

Every member of the A. O. of S. E., who can possibly do so, should attend the supreme meeting of the Order.

The mass meeting of Monday, July 13, will be a grand event full of instruction and encouragement. All engineers and their friends, who are not members of the Order, are most cordially invited. The Reception Committee will see that all non-members are well entertained.

The dog days are well nigh upon us. And the hottest part of the summer is at hand.

CONDENSATION OF STEAM IN THE CYLINDER.

The following is an abstract of a paper by Prof. Edwin H. Hall on a thermo-electric method of studying cylinder condensation in steam engine cylinders, read before the American Institute of Electrical Engineers, New York, recently. Prof. Hall had made elaborate researches in the matter and conducted several tests the expenses of which were paid by the Rumford Fund of the American Academy of Arts and Sciences. Prof. Hall says:

The subject of cylinder condensation is one that possibly would come more aptly before the mechanical engineers than before the electrical engineers, and yet most electrical engineers are to a greater or less extent mechanical engineers, and the time seems not yet to be near when we can dispense with the steam engine in the practical applications of electricity. The methods for turning the energy of coal directly into electric currents, I believe have not yet been put into application. The subject of cylinder condensation is one that has always been prominent in the study of the steam engine. Before the time of James Watt, as you are all aware, at every stroke the cylinder was filled with steam, and then it was cooled down by pouring water on the outside, or by admitting water into the inside, so that whenever the steam was admitted it found the cyliuder cool. A large part of the steam admitted at every stroke was turned into water at once on admission, and some of it was doubtless turned back into steam during the stroke, but much of it went out as water in the end. Watt introduced the independent condenser, by means of which the steam is removed from the cylinder without cooling the latter down, as it was cooled before; and yet it is still believed that a very considerable part of all the steam that enters the cylinder is condensed upon the inner surface of the cylinder; that some of this is re-evaporated during the stroke, but that a very considerable part remains as liquid at the end of the forward stroke and is only turned back into steam during the back stroke. when it is a disadvantage rather than an advantage, for it has to be expelled by the returning piston. It is considered that in some engines as much as 25 per cent. of all the steam that enters the cylinder goes through the cylinder as water—that is, during the forward part of the stroke. Writers upon steam engineering have devoted a good deal of attention to the discussion of the cause of cylinder condensation, with perhaps less attention to suggestions for remedy. The cause of cylinder condensation is this, that when the cylinder is thrown into communication with the condenser, rapid evaporation takes place of the water remaining on the wall, and that rapid evaporation under the diminished pressure cools greatly the cylinder wall. A little more than two years ago (January 17, 1889), Mr. Dickerson, of New York, gave an address before the Electric Club, of New York, I think, in which he advanced the proposition that the peculiar character of the indicator card of a steam engine which was supposed to show cylindrical condensation and re-evaporation was due to the leakage by the valves—leakage in by the valves at one part of the stroke, leakage out by the valves at another part of the stroke. He made the statement that the steamers in the waters about New York city would travel four or five miles an hour with the valve between the boiler and the cylinder closed. I do not know how accurate that statement was. I have never seen any statement in contradiction of it. Mr. Dickerson's paper excited my interest—perhaps more than it would have excited my interest if I had been a trained steam engineer. I knew that this was a matter in controversy between steam engineers—that they were by no means at one as to the amount of cylinder condensation, and by no means in agreement as to what caused the cylinder condensation, some believing that the steam coming in was cooled by contact with a layer of water remaining over from the previous stroke—the layer of water upon the inside of the cylinder. They thought that you could hardly account by the action of the iron alone for the very sudden condensation of the large amount of steam that is condensed. Mr. Dickerson's paper, then, stimulated me to undertake an investigation of this matter in a direction in which it had not been approached before, so far as I know. Steam

engineers have invariably, so far as I know, examined this question by study of the indicator card, examining the pressure at different parts of the stroke---the pressure and volume, and finding out how much steam they indicate. Knowing the the pressure at one part of the stroke, and the volume occupied by the steam, we can tell what weight of steam there is in the cylinder as *steam*. It is found frequently that there is more steam in cylinder at the end of the stroke than at the beginning of the expansion. According to Mr. Dickerson, that was due to the leakage by the valves by which steam was admitted, when the pressure in the cylinder fell low. It seemed to me that we might test the question, how much heat enters the cylinder wall by a thermo-electric method.

POINTS ON OIL ECONOMY.

BY F. B. FLINT.*

To a concern employing machinery to any considerable extent, the question of oil consumption is one of the utmost importance. Carelessness in the purchase, on the one hand, or intelligent judgment based on tests on the other, in the case of this article alone, may suffice to tip the scale of fortune toward deficit or profit. There are various requirements that a good machinery oil must fill. It must be a good lubricant, must not gum, must have the proper body for the use to which it is put. That is, a heavy engine oil should not be used alone on dynamo bearings. We may mix it with paraffine to get the proper body, or better, use paraffine alone. Vice versa, a paraffine should not be used on heavy engine bearings. In the old days of animal oils, gumming was a constant source of trouble. Bearings had to be taken a part periodically to be cleaned. With the use of petroleum oils now-a-days we seldom have any such trouble.

There are many forms of apparatus designed to test these essential requirements of oils, some very complicated. A favorite and simple device is called the viscosimeter. It consists merely of a glass tube, graduated to hold a certain quantity of oil, with a small orifice at one end, designed to let the oil escape in drops. The length of time necessary for the oil to pass out through the orifice, as compared with the length of time necessary for some other oil to do the same thing, furnishes a comparison of the relative viscosity of the oils. People making this test take viscosity as their criterion, and assume that lubricating quality varies directly as the viscosity, which is perhaps true, though the tendency to gum is made no account of in this method of testing. For testing lubricating quality there are Thurston's machine, Tower's, etc. An extremely simple and efficient form of apparatus has been used by the writer for several years in a great number of experiments, with entire satisfaction. It consists of a shaft 2 7-16 inches diameter, revolving at any desired speed. A standard bearing is used for all oils, say a good brass. The weight is applied equally on the ends of a balanced equal-arm lever. Now then, the experiments may be performed in two days. A given quantity, or so many drops, of oil may be furnished the bearing, and the time noted which it takes for a thermometer inserted in a quarter-inch pipe screwed into the top of the bearing to show a given temperature. This gives us the resistance to heating of the oil, which varies according to its lubricating qualities. Of course the lever must be kept level, and to do this we place at a known distance from the center of the shaft a support resting on delicate scales. This support serves to keep the apparatus from overturning, and by the scales gives the moment of the friction. From the scale reading by a simple equation the co-efficient of friction of the oil, or its value as a lubricant, can be computed.

Another way that may be followed is to supply the bearing with constant lubrication by pressing against the shaft directly under the standard bearing, a quantity of waste kept saturated with oil by partial immersion in an oil cavity. A suitable arrangement may be run out of lining metal, or be made of a wooden block hollowed to fit the shaft. This apparatus gives reliable results. Oils varying in price and true worth by only a cent per gallon, may be selected every time with accuracy. In the present state of unreliability of oils some such means of testing is indispensable.

*In the *Mechanical News*.

MAKING WOOD SCREWS FIFTY YEARS AGO AND NOW.

An aged Englishman has written an interesting story, published in the Cleveland *Examiner*, describing how wood screws were made in his native town "over there" fifty years ago, and comparing (or contrasting) that old style with the operations of the modern screw factory with which he is acquainted at Cleveland, O. The proprietors of the old and the new are also contrasted. Here is what the writer says:

The proprietor was a man between sixty and seventy years of age, nearly six feet tall, with large eyes, a long wrinkled face, and a stern expression of countenance, which gave him a repulsive appearance.

In addition to being the proprietor of the factory, he was a preacher, a faithful disciple of Calvin, a firm believer in the doctrine of predestination, and he had no sympathy for any one outside of his peculiar faith.

The writer, with others, used to visit his church with its twenty worshipers, to watch his eccentricities, and listen to what we were taught to believe was outlandish doctrine. On some of these occasions, when expounding his favorite theme, the preacher, to give effect to his utterances, would lean over the top of the pulpit to his son, who occupied the reading desk below, and bringing his fist down with great emphasis, would exclaim: "There are children in hell not a span long; isn't that so, my son?" The son would reply, "Yes, father," and the little flock would endorse it with a loud Amen!

We mention the above incident with a view of contrasting two men of opposite religious thought, and two systems of making wood screws fifty years apart. One under little or no education and free trade, the other under advanced religious thought, a mechanical education and American inventions, *fostered* by the protective tariff.

In England fifty years ago, and to some extent to day, wood screws were made by hand, by a slow, laborious process, especially for women. The wire of the different sizes required came from the mill in long coils. This was then cut into half inch, one inch, or the length required, a little being allowed to form the head. Each piece of wire was one at a time placed in a die with a counterbored top, and a man or boy with a hammer would drive down the projecting portion of the wire into the counterbore of the die, and this would form the head. The future screw, after the head was turned by hand, was ready for threading.

The threading machine consisted of two upright, slotted frames, about eighteen inches high, and fifteen inches wide, which were made fast to a wood bench. In the slots were two jaws into which the cutting dies were placed. The lower jaw was a fixture, but the top one was made to move up and down, as required. Attached to the top jaw and running under the bench was a long lever, at the end of which was placed a large stone or block some 50 or 200 pounds in weight, to give the required pressure to the jaws, to enable the tempered steel dies to cut the wire.

On the top of the bench was an upright bar, into which was jointed a long lever, or fulcrum. This was also connected to the bottom lever, with the uprights attached. On the bench was also fitted in supports a long spindle, with jaws at one end and a crank at the other. In the jaws of this spindle the blank to be threaded was made fast, and when the female operator would with the left hand, pull down the fulcrum, which would lift the weight and open the jaws at the same time. With the right hand she would place the screw as far as the thread was to be cut on the lower die. She would then loose the fulcrum and the weight would be on the screw, when she would turn the spindle with a backward motion, which would bring the screw out of the die with the first impression made upon it. The operator would then pull down the fulcrum again, place the screw in position, and again turn the spindle back. This operation would have to be gone through several times, then the jaws would meet and the screw would be finished threading. It will be seen that this was necessarily hard and slow work, for with the left hand the operator had to pull down the fulcrum, which raised the heavy weight, and with the right to turn the crank, while the heavy pressure was on the screw. The girls worked ten hours a day, and when they had become expert could earn ten pence, or twenty cents a day. Five shillings or $1.25 per week.

The screws were then slotted by hand, and, after being washed they were ready for the market. It will further be seen that by this process of threading the screw was all one thickness, and when using it, it was necessary that a hole should be bored in the wood before the screw would enter.

We may here remark that bolts for railway purposes one inch thick and upwards were at this time threaded by women using the same process. The operators were the real motive power, the arms and body being constantly in motion, and they were as much a tool as the machine. The tendency of such work was to debase rather than elevate the standard of intelligence. Now mark the contrast.

An idea of what is being done to-day, in that line, may be formed from a description of Union Steel Screw Co.'s works, at Cleveland. The building, which is of red brick, is about 200 feet on Case avenue, five stories high, with a tower in the center. In the rear is another building about the same size, the two being connected by elevated passage ways. At the end of the two buildings is the engine room, in which is a 300 horse-power engine. The driving-wheel, which is 20 feet in diameter, is encased in a wood frame. This wheel, which is a gear, is connected with a smaller one, which revolves at the rate of one mile a minute, and so perfectly true is this ponderous wheel turned, that not the least noise or jar is observed when the two are in motion.

On going through the many rooms we were struck with the excellent arrangement of the machines, and every box, either full or empty, was placed in its proper position, and were as much in line as if a square or plumb line had been used. Every room was large, well lighted and properly ventilated. The floors were scrupulously clean—not a particle of dirt or grease could be seen, it being the rule to scrub the floor twice a week. Every part of the machinery where there was danger was properly guarded, and everything necessary to ensure the safety and comfort of the employes has been done.

While going through the different rooms it was plain to be seen that Mr. J. A. Bidwell (the Superintendent) did not look upon those under his care as subjects fit only for eternal punishment, like the one referred to at the commencement of this article, because they were outside the law of predestination, for he is a firm believer in the doctrine that all men are born with equal rights and privileges, and, as Burns put it,

"The honest man tho' e'er sae poor
Is king o' men for a' that."

In carrying out this conviction he treats his help with kindness and justice, and in going among his employes he was received more like a father of a family than a boss. As a result of this kind treatment, strikes and discontent is unknown, and as far as the Union Steel Works is concerned, the labor problem is solved.

Having described the hand-made screw machines, we will now see what American inventions, under the influence of a protective tariff has accomplished.

In each room are long lines of machines arranged in perfect order, performing their several operations, and each part of the machine moved perfectly in time, and more correctly than human fingers could possibly do. One neatly dressed young woman, instead of being the motive power as by the hand process, could attend to several machines and see that they were properly supplied with material, and keep the cutters in proper order. In other words, she could look on while the machines did the work, using intelligence instead of physical force.

The screws are made by three principal operations, known as heading, turning and slotting and the threading.

THE HEADING MACHINE.

A large coil of wire is placed in front of the machine, which is attended by a man. A pair of rollers take hold of the wire and inserts in a die sufficient quantity, to form the head and body. This

is cut from the main wire by a pair of steel dies. A side motion is then made by the machine, when the wire is struck by a hammer, or plunger and the projecting portion is driven into a recess, which forms the head. At this stage the future screw is called a blank. A large number of these machines are in operation, and some idea can be formed of the number which can be made in a day when a machine can cut off and head from 40 to 350 blanks per minute, according to the size and length of the blank. This operation requires no labor on the part of the operator only to see that the machine is fed and kept in good condition, and when the machine is once started it goes right on until the coil of wire is used.

TURNING AND SLOTTING.

These blanks are then taken to a turning and slotting machine, and a large number placed on a revolving hopper. A long forked arm descends into the hopper and picks up a number of blanks and holds them by the head in an upright position. When full it ascends to an angle, and the blanks fall by the law of gravitation to an horizontal position in the arm. Here a pair of pinchers, formed like a thumb and finger of the hand, takes it out of the arm and places it in the chuck. The tool then takes its place and the head is turned true to the body. When this operation is complete the machine makes half a revolution when another chuck appears, and the fingers perform the same operation as before. While this is being done the blank in the first chuck is having the head slotted by a circular saw. When the slot is completed it is brought to its first position. The burr is taken off by the cutter, when the jaws of the chuck are opened and a plunge drives out the screw to a receptacle awaiting it. It is astonishing to watch these life-like machines when in motion, and see how cleverly each part of the machine performs its share of the work, just at the proper time and in the most perfect manner. The blanks are then washed and are taken to another room, where the threading operation is performed.

THE THREADING MACHINE.

This machine has a hopper, into which the blanks are again placed, and a forked arm takes them up in the same manner as the turning and slotting machine, but on this occasion the nimble fingers takes out the blank and places the head in position where it is held fast, with the body against a rest. When all is ready the tool which cuts the thread is started and moves from the head to the point. As soon as it reaches the end of the blank it moves back like a shot, and again starts on the same journey. From four to twenty-four cuts are made before the threading operation is complete, when the screw is dropped into a box. By this time the nimble fingers are again ready to take up another and place it in position. No time is lost, no false move is made, but the machine goes on with its work with the regularity of perpetual motion. The cutting tool, as it travels along the screw, is guided by former, which gives the screw that perfect taper and symmetry which enables it to cut its way into the wood without the necessity of first boring a hole, as must be done in the case of the hand-made screw. The screws are again taken to a washing machine, which, for mechanical ingenuity, is quite in keeping with the others.

THE WASHING MACHINE.

Here the screws are placed in a perforated iron bucket, and lowered into a tank of boiling water. When hot the machine is set in motion and the bucket is taken out of the tank. The screws are then emptied into a large iron sieve, mixed with saw dust. The sieve is started, and travels forward and backward with a rapid motion, when soon the screws are left alone in the sieve bright and clean. This machine requires the services of three men to put in the screws and take them away, but the real work is done by the machine.

The screws are then taken into the sorting room, where a long row of girls sit at a table sorting the bad from the good and the blanks from the finished article. They are then taken to other tables where a gross is counted and placed in a box on a scale. The girl then fills another box from the pile and carefully balance it with the box on the scale, and when the balance is exact the box is closed, and the wood screws are ready for the market.

A very large quantity of the product is put into boxes, and to supply the demand five box making machines are required. A brief description of these may be interesting. Large sheets of thin wood, made from spruce pulp, are cut into the required size, which run from one inch to six inches square. These are cut into the shape required to form the bottom, sides and top. These are then taken to a very complicated and interesting machine, presided over by a young woman who sits as stately as a queen on a throne. She places a pile in a certain position, when a pair of pincers picks up the top one and carries it forward. Here a pair of plunges, the ends of which are coated with glue, come down and glue the parts which are to adhere to each other. It is then taken forward, when a plunger the size of the inside of the box descends and takes it down through a shaper, when the glued parts are brought together, and the box left in a receiver. This receiver is a wheel, placed in a horizontal position, in the rims of which is from twenty to fifty compartments, and by the time it has made one revolution and the last compartment is filled, another plunger descends and pushes out the box into a basket, from which they are removed by an endless belt. It will be seen that after the first revolution of the receiver that one box is shaped and left in one compartment of the receiver, and at the same time the finished box is removed. Each machine is overlooked by one person, and they will do as much work in one day as 25 men and 300 girls could do by hand.

THE HARRY HOHN FUND.

Contributions to the Harry Hohn Fund should be forwarded to the treasurer, Franklin R. Moore, 727 Filbert St., Philadelphia, Pa. He reports receipts of the following:—

American Engineer Pub. Co.	$15.00
Jefferson Young, Jr., S. C. E.	10.00
Eben Hill Council No. 2, of Conn.	12.00
Kensington Council No. 3, of Pa.	10.00
Welcome Council No. 2, of Pa.	5.00
Manayunk Council No. 9, of Pa.	5.00
Forest City Council No. 2, of Cleveland, O.	5.00
Geneva Council No. 13, of N. Y.	7.20
P. H. Bullock, Warnerville, Mass.	5.00
Laclede Council, No. 1, St. Louis, Mo.	5.00
Buckeye Council No. 4, Canton, O.	2.00
St. John Council No. 1, Bridgeport, Conn.	10.00
East St. Louis Council No. 4, East St. Louis, Ill.	8.00

Treasurer F. R. Moore, whose postal address is given above, says: "We received one check payable to Harry Hohn, and one money order was sent to our corresponding engineer. It would be much better, and will save time, if all checks and money orders, intended for the above fund, be made payable to me; and as soon as I receive the same I send the particulars for publication in The American Engineer at once."

A GENIUS.

It is strange how some minds will develop into other channels than that of their own professions. Many have made successes in inventing articles and machines often without previous experience in mechanics, and it may be said very few have proved failures.

A case probably of notice is a boiler conceived and designed by Mr. C. Shrine, of Grand Rapids, Mich., a chemist and druggist, who has developed into quite a mechanic. The boiler mentioned is of the upright type, for use in his own factory, and shows considerable ingenuity. It has a main water flue 8″ dia. from tube sheet in fire box to the water bottom, thus given great heating surface and getting complete circulation. The water bottom has a good settling chamber when water is not circulating. Deposit is easily removed by hand hole and blow off on bottom. The breeching is so arranged that tubes can be cleaned without much trouble, or removing any part of it.

Now, this inventor's mind is on perfecting a boiler that the cleaning of tubes, inside and outside, will be possible without the aid of boiler makers. Most of the machines used in his fly-paper factory are of his own designing.

Stephen Christie.

BOILING BRICKS IN TAR.

The coating of brick and wooden structures with coal tar, as a rough-and-ready means of preserving them from the action of damp, has been common from the earliest days of the gas industry. It has also been usual in chemical works to protect the stones used in the construction of acid tanks, etc., by a preliminary soaking in heated tar. But the great improvement in strength and impermeability to moisture which results from the simple operation of boiling bricks and stones in gas tar is certainly not so generally known as it should be, says *Industries*. Professor Lunge, in the new edition of his work, "Coal Tar and Ammonia," draws attention to the subject, and indicates several useful applications. He points out that drain and roofing tiles, which are quite porous and brittle as they leave the kiln, may be rendered absolutely water-tight and much stronger by immersion in a bath of hot tar. Building stones are also greatly improved by similar treatment; and for many purposes the dead black color which results is an advantage rather than an objection. The tar should be deprived of water and its most volatile oils; and to produce good results, the bath must be maintained at a temperature of at least 100 degrees C. The articles to be treated should be thoroughly dried and allowed to remain in the tar for some time.

The above is a simple process, from which much benefit may be derived. "To spoil the ship for a pen'orth o' tar" is an adage which implies the great value of tar, and if it accomplishes one half the good which Prof. Lunge claims for it, it is well worth trying at all events.

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COMPRESSION IN STEAM ENGINES—THE VALUE AND DRAWBACKS OF IT.

BY F. M. LUDLOW, M. E.*

Compression is useful in taking up all lost motion in the reciprocating parts of an engine. And so far as this feature is concerned, it only remains to ascertain the amount in pounds per square that is necessary to take up the slack motion, and give the engine a quiet and smooth operation. As the amount of compression depends entirely upon the momentum of the moving parts, it is obvious that it would increase with the weight and velocity of the reciprocating portions of the engine. Hence, in high speed engines making 275 to 300 revolutions per minute, much more compression would be required in engines of longer stroke and less piston speed. High speed engines usually have a piston speed of about 600 per minute, while slide valve engines and Corliss engines range generally from 400 to 500 per minute. The momentum of the reciprocating parts increases as the square of the velocity, consequently taking engines at 500 feet and 600 feet the momentum in each case would be as 25 to 36.

The writer has found in many years practical experience, with engines of different styles, with ordinary slide valve (or similar low speed engines) a compression of 20 to 25 pounds pressure above the atmosphere (or say 40 pounds gross pressure including the atmosphere), when the piston speed was not over 400 feet per minute, would give sufficient "cushion" to insure a smooth and noiseless motion, while for speeds of 600 feet it was necessary to run the compression up 35 to 45 pounds net to reach the same smoothness of motion. It may be noted here that single valve high speed engines,

*In *The Tradesman*.

as the compression unavoidably increases with the rate of expansion, when cutting off steam say at ¼ the stroke, reach a compression of forty-five to fifty-five pounds above the atmosphere. The makers of these engines claim that this is no defect but rather an advantage; inasmuch that with say sixty pounds initial steam pressure, if we compress up to say fifty-five pounds, filling all the waste passages with the compressed vapor nearly up to the initial pressure of the entering steam, that this will require but little boiler steam to supply the return stroke. This looks plausible at first sight, but if we consider each stroke by itself,

THE FALLACY OF THIS REASONING

is plain. We can see plainly that in a moving piston opposed by say twenty to twenty-five pounds ultimate pressure, or two to five pounds through the whole stroke, detracts exactly that much from the effective force of the driving steam. In fact the indicator on a single valve high speed engine, cutting off at one-fourth to one-eighth stroke, giving a compression of forty to fifty pounds above the atmosphere, will show a loss of fifteen to twenty-five per cent. below the catalogue ratings of these engines, the loss increasing rapidly with the higher expansion. Part of this loss is undoubtedly due to cylinder condensation, which increases also rapidly with high grades of expansion. The question of how soon the exhaust should be closed to produce a given amount of compression, depends upon the cubical contents of the steam passage and the amount of piston clearance. To illustrate this point, we will take a single (slide) valve engine, 12″ dia. 24″ stroke, making, say, 400 feet per minute. We will assume that the steam parts are 1″x20 and 12″ long from valve face to cylinder bore; this would give 120 cubic inches contents, add to this say ½ piston clearance, area of cylinder 113″x ½″=57″x120 is 177 cubic inches total for waste passages. We will assume that a compression of 30 pounds above atmosphere is desired, or 45 pounds gross, taking the atmospheric pressure at 15 pounds (to avoid fraction) we have then a compression of 3 to 1.

We have found that our waste passages contained 177 cubic inches, which space we desire to fill with vapor compressed up to a ratio of 45 pounds per square inch gross, based in a ratio of 3 to 1. Hence 177″x3 is 531″. Now, when the piston has completed its stroke, we still have these 177″ waste passages left filled with compressed vapor. Hence 531″ total contents, less 177″ waste space, leaves 354 cubic inches to be covered by the moving piston. In the case of a 12″ cylinder, as assumed, area 113 square inches, how many inches of the stroke would be required, after the exhaust has closed, to produce the desired compression? Evidently the 354″ desired contents divided by the 113″ area would show us that it would be necessary to close the exhaust at 3⅛″ before the piston has terminated its stroke. This rule will be found closely approximating the Indicator results, but a it takes no notice of cylinder condensation, and re-evaporation towards the end of stroke, it is not exact, although sufficiently so for practical purposes. All the waste passages are losses of steam in doing a given amount of useful work, and

NO AMOUNT OF COMPRESSION

can recover these losses, and greater the number of revolutions of the engine per minute, the greater is the percentage of loss due to the waste passages. While compression is useful up to the point required for a "cushion," it is in the nature of a necessary evil, not in any respect a benefit. For as we dispense with the piston clearance and the waste spaces from valve to cylinder, in so much we save considerably in the cost of a given amount of useful work done. To illustrate this point we will take two cylinders, each 12″x24″, one with the short D slide valve, with ports 1″x10″x12″, the other with the so-called long valve, with ports near each end of the cylinder, say 1″x10″x6″, 60 cubic inches contents. Both engines, after the exhaust has closed, commence with 15 pounds atmospheric resistance and end with 45 pounds gross. A short calculation will show that, while the short valve engine would begin compression at 3⅛″ before the end of the stroke to reach 45 pounds gross, the long valve engine would not begin its losses from compression earlier than about 2 1-16″ before the stroke terminated. It is evident, therefore, that the average loss on the whole stroke would be very much in favor of the long valve engine. In fact, the loss would be say 33 per cent. less with the long valve.

LITERARY.

"An Honest Hypocrite" is the title of a new novel, inspired by the recent agitation in the religious world, written by the Rev. Edw. Staats DeGrote Tompkins, and published by the Cassell Publishing Company. The trial of Dr. Briggs, the investigation of Dr. Heber Newton, and the condemnation of Macquarey, as well as the excitement about making Phillips Brooks a Bishop, are all reflected in this work. Indeed, one of the principal characters in the book is said to be drawn directly from Dr. Newton. The book is the work of a clergyman who sympathizes with the broader doctrines that are prevailing to-day, and who has put his views into the form of a novel for the sake of giving them wider currency than they would have if put forth as either essay or sermon. The crying need of the poor in great cities is another question that is agitated in this book, which is made particularly timely by the recent organization of the University Settlement for the establishment of libraries and clubs in the tenement house district of New York City. "An Honest Hypocrite" is full of plot, dramatic in action and in sympathy with the great movements of the day.

The Garden City Directory is a useful pocket reference book. It contains a list of all the important places in Chicago, together with legal fare for conveyance, etc. It is published by R. E. Woodward, 210½ S. Clark street, Chicago.

Scribner's Magizine for July (beginning the tenth volume) has its leading article on a subject which attracts particular attention at this season—"Speed in Ocean Steamers." The author, A. E. Seaton, is connected with a large ship-building firm in England, and makes perfectly plain to untechnical readers the various conditions which must be borne in mind in designing ocean greyhounds, and the most advanced methods which have met them. The illustrations show a number of the fastest steamers afloat. This issue contains also two illustrated out-of-door articles—one on "Izard Hunting in the Spanish Pyrenees," and the other on fishing for the black sea-bass on the Pacific coast. The number is unusually rich in fiction, containing four complete short stories; by George A. Hibbard, the late John Elliott Curran, Edith Wharton, and George L. Catlin, U. S. Consul at Zurich. There are three articles of political importance—one on "Starting a Parliament in Japan," by Prof. John H. Wigmore, of the University of Tokio; another giving a civil engineer's glimpse of the revolutionary republic of Hayti; and a third summarizing the romantic history of outlawry on the Mexican border. A picturesque account of an old Danish town; a literary essay of unusual quality on Landor, and poems by John Hay and Mrs. James T. Fields, complete a number of remarkably varied interest. The frontispiece is the last one of Mr. J. R. Weguelin's notable full-page illustrations for selected Odes of Horace.

The August issue of *Scribner's Magazine* will be a fiction number containing four illustrated short stories; several unillustrated ones, and the beginning of a remarkable serial, "The Wrecker," by Robert Louis Stevenson and Lloyd Osbourne.

SPECIAL BUSINESS NOTICES.

The Multiple Speed and Traction Co. of 54 Lakeside Building, Chicago, expect to have the contract for building and operating their multiple despatch railway at the Columbian Exposition. All who take a ride thereon may travel at the rate of three or six miles an hour as they choose. A description of this interesting scheme has already been published in our columns.

The Hoppes Manufacturing Co., Springfield, Ohio, has just completed and shipped two of the largest live steam feed-water purifiers ever constructed. They are 68 inches in diameter by 26 feet long, and are each of 1,000 horse power capacity. They are to work in connection with 2,000 horse power Babcock & Wilcox boilers. The purifiers were designed and built for the Louisville Gas Co., Louisville, Ky., to be placed in the new electric light station being erected by that company. The Hoppes Manufacturing Co. also have the contract for furnishing the boiler feed-pumps for this station.

Wm. Baragwanath & Son, report business as being good. They have just closed a contract for one 1,000 horse power heater for Warren Springer, and one of 800 horse power for the New Fair building. Among the recent improvements made by this house are two very large punch and shearing machines from the well known house of Hilles & Jones of Wilmington, Del.

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MAP OF THE UNITED STATES.

A large, handsome map of the United States, mounted and suitable for office or home use, is issued by the Burlington route. Copies will be mailed to any address on receipt of 12 cents in postage by P. S. EUSTIS, Gen'l Pass. Agent, C., B. & Q. R. R., Chicago, Ill.

CONTRACTS OPEN.

Pumping Engines.—Sealed proposals will be received by the City of Savannah, Georgia, until eleven (11) o'clock a. m., July 15, 1891, for furnishing and constructing two (2) High Duty Pumping Engines, each having a capacity of ten million (10,000,000) U. S. gallons per day, and the necessary boilers and other appurtenances pertaining to a pumping plant. All to be in accordance with general specifications on file in the water office, at Savannah, Ga., or which, with all other information, can be obtained from Thomas T. Johnson, Consulting Engineer, at room No. 29, No. 171, La Salle street, Chicago, Ill. Proposals must be made in accordance with the aforesaid general specifications. No proposals will be considered unless the party offering it can furnish evidence satisfactory to the Mayor and Board of Aldermen of the City of Savannah of his ability, and that he has the necessary facilities, together with pecuniary resources, to fulfill the conditions of the contract and the specifications, provided such contract should be awarded him. The right to reject any and all proposals, not deemed for the best interest of the city, is reserved. JAMES MANNING, Superintendent, Office Water-Works, Savannah, Ga., May 21, 1891.

Dredging.—United States Engineer Office, No. 366 Milwaukee street, Milwaukee, June 19, 1891.—Sealed proposals in triplicate, will be received at this office until 12 o'clock, noon, July 15, 1891, and then opened in the presence of bidders, for dredging at Milwaukee Harbor, Wis. Approximate amount of dredging to be done, 26,000 cubic yards. The attention of bidders is invited to the acts of Congress, approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. Proposals will be accompanied by a guarantee that if the bid is accepted, contract will be entered into within ten days after notice of acceptance. Preference will be given to material and plant of domestic production or manufacture, conditions of quality and price (import duties included) being equal. For blank proposals and information apply at this office. The United States reserves the right to reject any or all bids. Proposals will be endorsed on the envelope, "Proposals for Dredging at Milwaukee Harbor, Wis.," and addressed to Major CHAS. E. L. B. DAVIS, Corps of Engineers, U. S. A.

Pumping Engines.—Sealed proposals will be received by the City of Savannah, Georgia, until eleven (11) o'clock, a. m., July 15th, 1891, for furnishing and constructing Two (2) High-Duty Pumping Engines, each having a capacity of Ten Million (10,000,000) U. S. gallons per day, and the necessary Boilers and other appurtenances pertaining to a pumping plant. All to be in accordance with general specifications on file in the Water Office at Savannah, Ga., or which, with all other information, can be obtained from Thomas T. Johnston, Consulting Engineer, at room No. 29, No. 171 La Salle street, Chicago, Illinois.

Proposals must be made in accordance with the aforesaid general specifications. No proposal will be considered unless the party offering it can furnish evidence satisfactory to the Mayor and Board of Aldermen of the City of Savannah of his ability, and that he has the necessary facilities, together with sufficient pecuniary resources, to fulfill the conditions of the contract and the specifications, provided such contract should be awarded him.

The right to reject any and all proposals not deemed for the best interest of the city is reserved.

JAMES MANNING, Superintendent.
Savannah, Ga., May 21, 1891.

JULY 11, 1891. The American Engineer. VOL. 22, NO. 2.

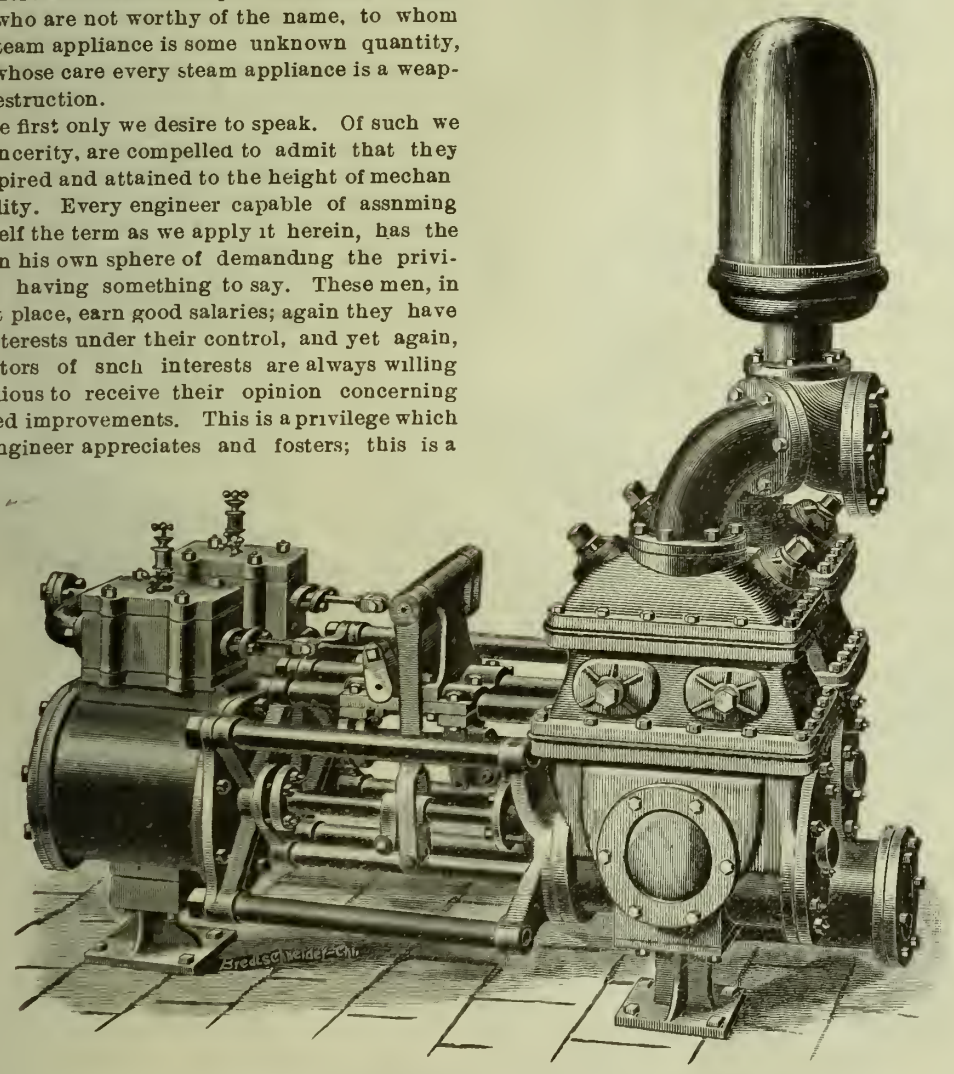
THE PROPER DEFINITION.

At last we have received "the proper definition" of the term engineer. The average student, says the author of this proper definition, can hardly make out what constitutes a real engineer, but those who understand somewhat of steam appliances would naturally say, "he is one who understands cause and effect in the application of steam." He must understand the care of steam boilers, consequent upon the strength of their manufacture; he must understand the care of engines, consequent upon their style and strength of manufacture; he must understand the principles of hydraulics and the results of hydraulic appliances, provided he is what the term engineer implies.

There are various grades of engineers. There are those to whom every appliance with which they come in contact has its merits and demerits, which to their quick eye are at once observant; there are those to whom all appliances with which they come in contact are interrogation marks; appliances with which they have to experiment, before they know whether they are good, bad or indifferent; and, last of all, there are those who style themselves "engineers" who are not worthy of the name, to whom every steam appliance is some unknown quantity, and in whose care every steam appliance is a weapon of destruction.

To the first only we desire to speak. Of such we in all sincerity, are compelled to admit that they have aspired and attained to the height of mechanical ability. Every engineer capable of assuming to himself the term as we apply it herein, has the power in his own sphere of demanding the privilege of having something to say. These men, in the first place, earn good salaries; again they have large interests under their control, and yet again, proprietors of such interests are always willing and anxious to receive their opinion concerning projected improvements. This is a privilege which every engineer appreciates and fosters; this is a privilege which every true engineer will exercise for his employer's benefit, knowing that his employer's profits redound to some extent upon every employee, and to such we now address ourselves, this time in reference to pumps. An important feature in the make up of every steam plant is a pump, whether used as a boiler feed pump or for tank circulation or hydraulic work. Various pump houses have ascribed to themselves full knowledge of any and every use to which a pump may be applied, and still others are content to be guided by the knowledge and facts as given by engineers. To one of the latter houses we desire to call some attention. They are like the man who at fifty years of age knows absolutely nothing, who having experienced the ups and downs of life is satisfied that there are many things he knows nothing about, and that in all things he is open to receive information and correction; in fact a house which is always willing and anxious to secure the advice and knowledge of experienced engineers. Such a house the Wheeler & Tappan Company of Chicago claim to be. This company have built themselves up through the friendship of engineers, as having had considerable association with such it has become second nature to them, when called upon to rectify trouble or mistake, to apply to those in charge of the steam outfit. We do not wish in any way to detract from the prestige, knowledge or influence of the proprietor; but they themselves will admit that they are willing to expend their money for the hiring of competent men to take charge, provided they keep in order their extensive equipments.

The Wheeler & Tappan Company have been in the pump business for over sixteen years as proprietors, previous to which they were in the employ of the Geo. F. Blake Mfg. Co., of Boston, Mass. They came to Chicago in 1875, having heard of the dearth of competent pump men to take charge of repairs. For nearly ten years they worked might and main to secure sufficient foothold to commence the manufacture of steam pumps on their own account, and have at length attained such prominence as to be called "the largest steam pump manufacturers west of New York city."



14″ x 10″ x 12″ Duplex Brine Pump, Tie-Rod Pattern.

Their line of patterns include every conceivable size and style of pumps used in the ordinary lines of business, and from a capital composed of simply muscle and grit they have reached a monetary capital of over one hundred and fifty thousand dollars. So much for reliance on engineers.

We would just call attention to their advertisements in this issue which will give some idea of their capability. Their pumps throughout are built to withstand the hardest possible strain, and eventually, they declare, to cost the least possible amount for repairs. There has been no desire on their part, at any time, to compete with the "promiscuous market" in their line of goods, taking the ground at all times "that things that are equal to the same thing are equal to one another," or in other words, an article costing say $100 is worth a profit of 15 or 20 per cent., making a selling price of $115 to $120. There is always a desire to buy for the least amount of money; but educated mechanics are ever ready to combat this promiscuous buying. Competent engineers will appreciate the foregoing, knowing that it is not to their interest or credit to have the plant under their charge composed of such an outfit, and they know also how to take care of a good thing when they have it. This firm has established agencies all over the United States with competent and reliable men, and have secured as their Eastern agent, Mr. Jefferson Young, Jr., the supreme chief of the American Order of Steam Engineers with headquarters at 401 and 403 S. Clinton St., Syracuse, N. Y. Mr. Young has been for many years in the pump business, and knows a good thing when he sees it, as is evident by his being called upon to fill such an exalted position as he does in the American Order of Steam Engineers. Being well versed in the merits of almost every steam appliance, he at length decided on Wheeler & Tappan Co.'s goods as being of sufficient merit to place before his brother engineers, and can honestly say, "I know they are right." Mr. Young is ably seconded in his agency by Mr. J. Will Clark, of Syracuse, who is also "one of the boys."

The firm of Wheeler & Tappan Co. was incorporated last April with Mr. Thos. J. Wheeler, as president, Mr. Amos K. Tappan, as vice-president, and Mr. Robert Forsyth, as secretary and treasurer. The manufacturing department is entirely under the charge of Mr. Merrill L. Jenkins who is a hydraulic engineer of the "first water." As jobbers they have been called upon to do an immense amount of special work and that such has been honestly and promptly executed is due to the care and intelligence of the last named gentleman. Excellence can only be attained after much care and study, and knowing Mr. Jenkins, as we do, we are pleased to give this testimony to his ability and expect from him great things for the future. He is with a house whose watchword is "forward," and that knows not the word "failing." The main office and works of this concern are at 12 and 14 S. Jefferson Street, Chicago, Ill. Write for their catalogue and if any member of the American Order of Steam Engineers, or any other reader, desires any special information on hydranlic appliances for any special duty, such will be cheerfully furnished by this company, especially if the applicant will state that he has read the descriptions of their pumps in The American Engineer.

WATER AS A LUBRICANT.

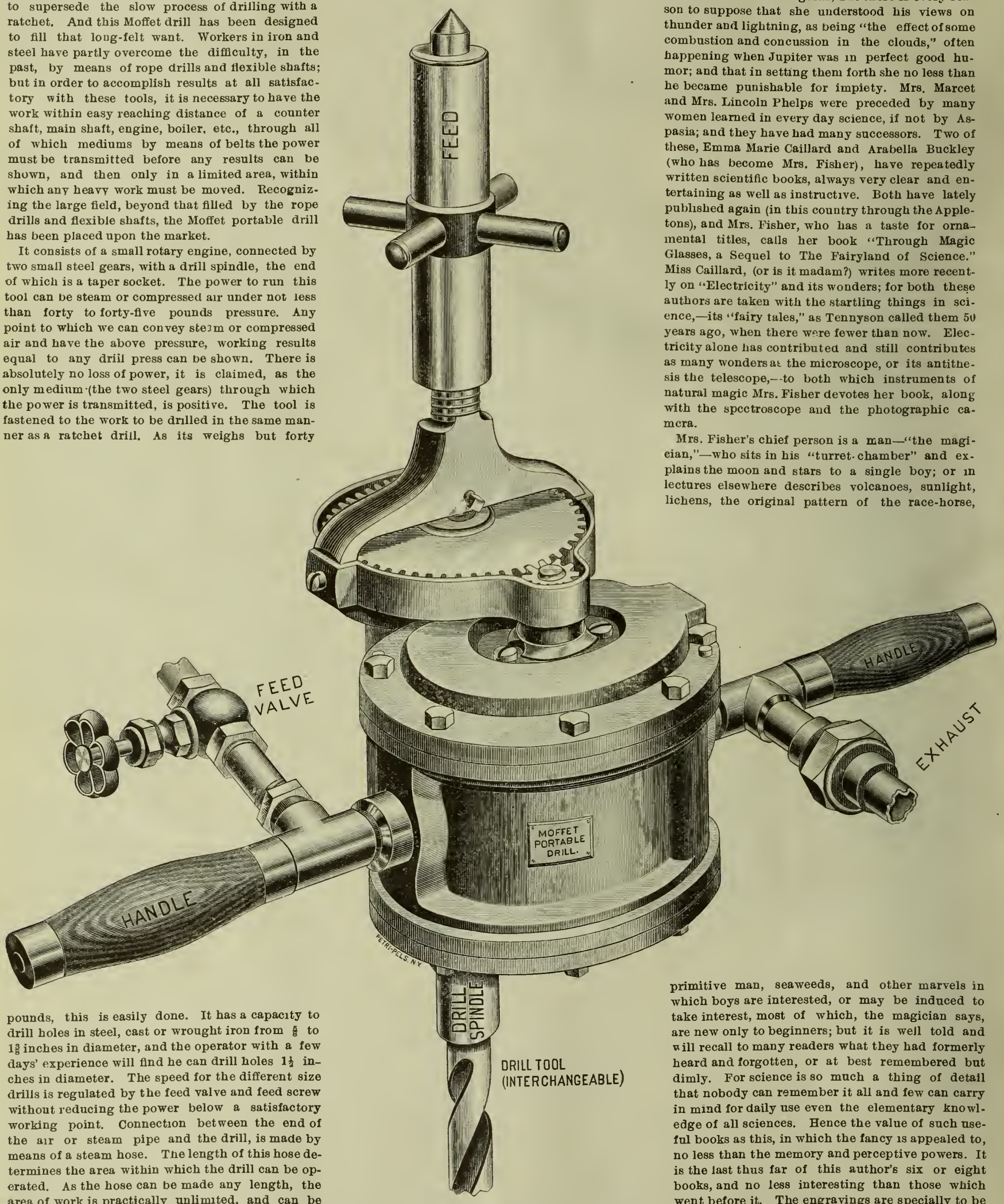
Water is a good lubricant if it is rightly applied, says the New York Railroad Men. A knowledge of this fact and the wit to use it at the right moment helped an engineer out of a tight place. He had to take the superintendent up the road on his engine for an important meeting. The superintendent was in a hurry, and they started out at a pretty lively pace. Everything went smoothly for a while, when the guides on the right hand side began to smoke. The engineer shut off, got down and found that guide in first-class shape as a frying pan, but its efficiency as a guide was seriously impaired. The superintendent got down too, and said, "put some water on her quick." "No, sir," was the answer, "if you put water on that guide now you will twist it all out of shape." "What are you going to do?" said the superintendent, "we haven't much more than time to get there now." The engineer said nothing, but he took his wrench and eased off the nuts on the stuffing box studs. enough to allow the steam to blow through past the piston rod. He reasoned that the steam blowing on the hot guide any condensing would cool it just as effectually and much more gradually than eight or ten buckets of water dumped on at once, while the water would at the same time act as a lubricant. They got up and started ahead easy. The engineer watched that guide with some anxiety, for he was not sure of the result. At the end of ten miles he stopped, went down and felt it. With a calm smile and an "I told you so" expression, he pulled out the throttle, drove ahead, and brought the superintendent to his meeting in time.—*Railway Review.*

THE MOFFET PORTABLE DRILL.

The accompanying illustration (on this page) shows the leading features of the Moffet portable drill, manufactured by J. G. Timolat, of 59 South Fifth ave., New York City.

A tool has been greatly needed, for a long time, to supersede the slow process of drilling with a ratchet. And this Moffet drill has been designed to fill that long-felt want. Workers in iron and steel have partly overcome the difficulty, in the past, by means of rope drills and flexible shafts; but in order to accomplish results at all satisfactory with these tools, it is necessary to have the work within easy reaching distance of a counter shaft, main shaft, engine, boiler, etc., through all of which mediums by means of belts the power must be transmitted before any results can be shown, and then only in a limited area, within which any heavy work must be moved. Recognizing the large field, beyond that filled by the rope drills and flexible shafts, the Moffet portable drill has been placed upon the market.

It consists of a small rotary engine, connected by two small steel gears, with a drill spindle, the end of which is a taper socket. The power to run this tool can be steam or compressed air under not less than forty to forty-five pounds pressure. Any point to which we can convey steam or compressed air and have the above pressure, working results equal to any drill press can be shown. There is absolutely no loss of power, it is claimed, as the only medium (the two steel gears) through which the power is transmitted, is positive. The tool is fastened to the work to be drilled in the same manner as a ratchet drill. As its weighs but forty pounds, this is easily done. It has a capacity to drill holes in steel, cast or wrought iron from $\frac{5}{8}$ to $1\frac{3}{8}$ inches in diameter, and the operator with a few days' experience will find he can drill holes $1\frac{1}{4}$ inches in diameter. The speed for the different size drills is regulated by the feed valve and feed screw without reducing the power below a satisfactory working point. Connection between the end of the air or steam pipe and the drill, is made by means of a steam hose. The length of this hose determines the area within which the drill can be operated. As the hose can be made any length, the area of work is practically unlimited, and can be carried on in the open air as well as in a shop; thus a piece of hose fifty feet long will allow drilling at any point in a circle one hundred feet in diameter. The drill can be operated in any position (horizontally or vertically) with equally good results. It is largely used for drilling, reaming and countersinking in bridge work, for drilling all kinds of iron or steel in structural work, vault work, heavy machine work, steam ship-building and repairs, drilling out rivets in boilers, tapping and screwing in stay bolts (for the latter work a pressure of from fifty-five to sixty pounds is necessary), etc.



Salt is a most excellent thing to use in sweeping carpets. It not only gathers up the dust and leaves the carpet bright and clean but there is always enough of the finer particles left in the carpet to act as a prevention to moth. Of course the very cheapest, coarsest salt may be used.

THE FAIRY TALES OF SCIENCE.

The zeal and success with which women cultivate and teach science has long been known. We are not expressly told that the Aspasia of Pericles wrote an essay popularizing the scientific deductions and observations of Anaxagoras; but there is every reason to suppose that she understood his views on thunder and lightning, as being "the effect of some combustion and concussion in the clouds," often happening when Jupiter was in perfect good humor; and that in setting them forth she no less than he became punishable for impiety. Mrs. Marcet and Mrs. Lincoln Phelps were preceded by many women learned in every day science, if not by Aspasia; and they have had many successors. Two of these, Emma Marie Caillard and Arabella Buckley (who has become Mrs. Fisher), have repeatedly written scientific books, always very clear and entertaining as well as instructive. Both have lately published again (in this country through the Appletons), and Mrs. Fisher, who has a taste for ornamental titles, calls her book "Through Magic Glasses, a Sequel to The Fairyland of Science." Miss Caillard, (or is it madam?) writes more recently on "Electricity" and its wonders; for both these authors are taken with the startling things in science,—its "fairy tales," as Tennyson called them 50 years ago, when there were fewer than now. Electricity alone has contributed and still contributes as many wonders at the microscope, or its antithesis the telescope,—to both which instruments of natural magic Mrs. Fisher devotes her book, along with the spectroscope and the photographic camera.

Mrs. Fisher's chief person is a man—"the magician,"—who sits in his "turret-chamber" and explains the moon and stars to a single boy; or in lectures elsewhere describes volcanoes, sunlight, lichens, the original pattern of the race-horse, primitive man, seaweeds, and other marvels in which boys are interested, or may be induced to take interest, most of which, the magician says, are new only to beginners; but it is well told and will recall to many readers what they had formerly heard and forgotten, or at best remembered but dimly. For science is so much a thing of detail that nobody can remember it all and few can carry in mind for daily use even the elementary knowledge of all sciences. Hence the value of such useful books as this, in which the fancy is appealed to, no less than the memory and perceptive powers. It is the last thus far of this author's six or eight books, and no less interesting than those which went before it. The engravings are specially to be praised for their excellence, combined with an ornate character, which is not aimed at in the merely scientific illustrations of Miss Caillard's "Electricity."

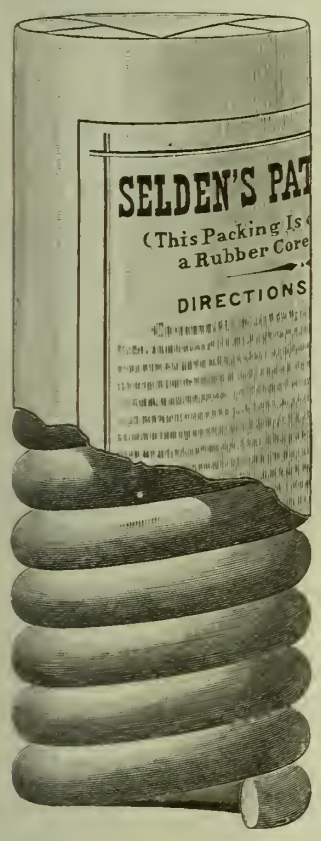
This second book is indeed most useful; for it treats concisely, accurately and historically of this

new scientific enigma, with so many possible answers, of which only a few have yet been guessed, and those not with entire certainty. Nobody yet knows what electricity is, nor is even its action known in many contingencies that may arise or have arisen. This author devotes her last chapter to the puzzle. "What is electricity?" which she does not seek to solve further than to suggest, as others have done before her, that electro-magnetism and light have much in common, and apparently make their astonishing movement through the once imaginary ether, which, she further intimates, may be the stuff of which all material things are made or modified. With this startling suggestion she closes a book which is one of the most interesting and instructive volumes of the present year. —*Ex.*

STUFFING BOX PACKING.

Probably there is not a thing about the engine room which has engaged the attention of engineers more than the packing of piston and valve rods, and starting with the twisted strand of hemp, next came the plaiting of the hemp into square and other shapes, which did good work on the slow speed engines using low steam pressure, but with the advances in those two points in engineering something better in packing was required, and today there are numerous packings on the market, many alike in everything but name, while others are of a distinct character.

The qualities most needed in a good packing are 1st: It shall cause the least friction; 2nd: Have



elasticity sufficient to take up any slight spring in the rod caused by varying strains; 3d: Not burn out quickly.

Of the packings which have been on the market long enough to test their merits the "Selden" is notable. It is the invention of a practical engineer of large experience. The materials of which it is composed are entirely free of any substances which can either score or corrode a rod, and the thousands of engines and pumps on which it has been used for ten years testify that it is a "stayer."

There are two kinds of the "Selden," the "Rubber Core Selden" which has a gum centre large enough to give elasticity but which "can never come in contact with the rod and cause friction," as the manufacturers state. It is also treated to withstand the burning action of steam and has a record of use on engines for over six years without wearing the rod the slightest, it is said.

The "Canvas Core Selden" is used more for the water ends of pumps and high hydraulic pressures, as in cotton compress, hydraulic plants of steel and tobacco works, testing pumps, boiler feeds and ice machines.

The "Selden" is made in all sizes from $\frac{1}{8}$" to 3", varying by sixteenths of an inch. Each coil is securely wrapped in manilla paper, to keep it clean from any dirt or dust, and a label on it, giving directions for using. The cut represents a coil with part of the wrapper torn away to show the packing.

OUR LIMESTONE INDUSTRY.

BY WILLIAM C. DAY.*

The production of limestone in the United States for the census year 1889 was as follows: For building purposes, 93,289,896 cubic feet, valued at $5,405,671; converted into lime, 18,474,668 barrels, valued at $8,217,015; stone for burning into lime, 478,082 tons, valued at $184,024; flux for furnaces, 3,894,337 tons, valued at $1,569,312; for street work, 46,491,622 cubic feet, valued at (2,383,456; for bridge, dam, railroad work, 26,679,012 cubic feet, valued at $1,289 [illegible] miscellaneous uses, 549,875 cubic feet, valued at $46,079; making a total value of $19,095,179. The expenditures were as follows: For wages, $10,121,985; for supplies and materials consumed, $4,227,246; other expenses of quarries, $743,483; making a total of $15,092,714. The capital invested in the industry amounted to $27,022,325; of this sum $14,771,500 was in land, $4,988,207 in buildings and fixtures, $4,541,623 in tools, implements, etc., and $2,721,295 in cash.

The name "limestone" carries with it the meaning "stone from which lime is made." Strictly speaking, therefore, it should apply only to the carbonate of calcium, which, by ignition, is converted into lime. The name, however, in practice covers quite a variety of materials which contain carbonate of calcium, but in very different degrees of purity. When limestone presents itself in crystalline condition, so as to be susceplible of fine polish and delicate ornamentation, it is known as marble.

Calcium carbonate is frequently associated with magnesium carbonate in varying proportions. When the proportion of the latter is small the stone is called magnesian limestone, but when the proportion becomes 54.35 parts of calcium carbonate to 45.65 parts of magnesium carbonate it receives the name of "dolomite," which, if crystalline, may constitute a marble, but if non-crystalline is classed with the ordinary limestones. The term "ordinary limestone" is commonly used to include all the grades and degrees of limestone except marble.

The limestones are mainly, though probably not entirely, of organic origin, resulting from the deposition and aggregation of shells, corals, etc., but at the time of deposition other materials such as clay, sand, iron, oxides, iron pyrites, mica, etc., may have been included, thus producing a large number of grades, which are frequently distinguished by names which imply the presence of the most characteristic impurity. Siliceous, argillaceous, and micaceous limestones are names in common use. Usually the presence of these impurities is an objection to the stone for almost all the great variety of uses to which limestone is applied.

Limestone of all kinds is readily susceptible to the decomposing action of acids, and this fact is very important in connection with the use of limestone as a building material or for purposes which involve its exposure to the weather. The atmosphere of large manufacturing cities is particularly liable to contain acid vapors, which, dissolved and precipitated by rain, cause rapid disintegration and defacement of limestone structures. The presence of impurities, rendering the stone absorptive and porous, are especially objectionable. Highly compact and pure limestones are less liable than other kinds to disintegration from acids, and dolomite, when pure and compact, is among the most durable when exposed to atmospheric agencies. Costly and rash experiments in the use of limestone for outside building have resulted within the last quarter of a century in causing the exercise of greater care in the adoption of limestone as building material under conditions favorable to rapid disintegration. When limestone is exposed to intense heat, such as is incident to a conflagration, the stone is to a greater or less extent decomposed into lime, and thus it is that walls built of limestone disintegrate and crumble to pieces in cases of serious conflagrations. This fact is one which should, of course, be carefully considered in the selection of limestone as a structural material.

The following statement shows the value of the output produced in each of the geographical divisions. The North Atlantic division includes the states of Connecticut, Maine, Massachusetts, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; the South Atlantic—Florida, Georgia, Maryland, South Carolina, Virginia, and West Virginia; the North Central—Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, Ohio, South Dakota, and Wisconsin; the South Central—Alabama, Arkansas, Kentucky, Tennessee, and Texas; and the Western—Arizona, California, Colorado, Idaho, Montana, New Mexico, Oregon, Utah, Washington, and Wyoming.

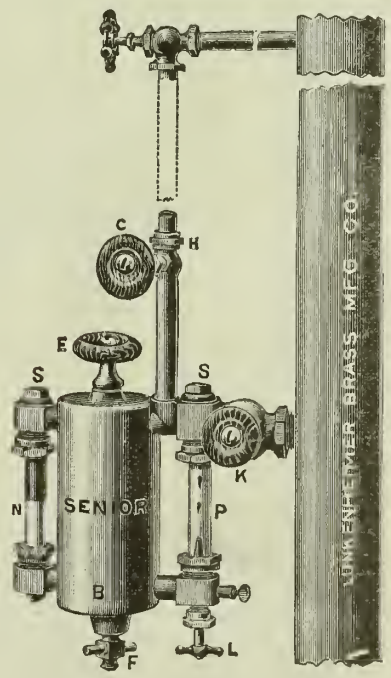
North Atlantic	$6,491,834
South Atlantic	464,171
North Central	10,185,203
South Central	937,351
Western	1,016,620
Total	19,095,179

From this it is evident that the North Central division is the most important for the production of limestone, $10,185,203 worth of the total $19,095,179 being produced from this division. The most productive states of the North Central division are Illinois, Indiana, Missouri, and Ohio, in the order named, three of these states producing more than $1,000,000 worth each, and Illinois more than $2,000,000 worth. In the North Atlantic division the most important states are Pennsylvania, New York, and Maine, in the order named, two of these states producing more than $1,500,000 worth each, while Pennsylvania produces more than $2,500,000 worth.

*Abstract of Introduction to Census Bulletin No. 78.

LUNKENHEIMER'S "SENIOR" LUBRICATOR.

Lunkenheimer's new and simplified "Senior" lubricator is highly spoken of, and is now by far the best, cheapest, and most popular cup on the market, as the manufacturers claim.



The "Senior" is a double connection cup and works on steam pipe only above the throttle. It is superior in quality and finish, substantial, ornamental, well proportioned, and suitable for first-class engines.

From a glance at the accompanying cut it will be seen that this lubricator has certain important special advantages. We need not enter into details here inasmuch as full directions for connecting and operating are sent with each cup.

The Lunkenheimer Brass Mf'g Co. guarantee every cup to be first-class in every respect. And certainly those in need of such a thing would do well to investigate the "Senior" lubricator.

The Lunkenheimer B. M. Co. also manufacture a complete line of valves, lubricators, oil and grease cups, etc. Their catalogue and discounts may be obtained for the asking.

The American Engineer.

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TO WHOM IT MAY CONCERN.

This is to certify that THE AMERICAN ENGINEER, of Chicago, Ill., is the only duly authorized official organ of The American Order of Steam Engineers.

JEFFERSON YOUNG, JR.
Supreme Chief Engineer A. O. of S. E.

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CONTENTS OF THIS NUMBER.

ELECTROCUTION was "the order of the day" at Sing Sing on Tuesday last. In the gray of the early morning four murderers were sent to the unknown world by way of the electric current. It seems that the culprits were seated, one after another, in the death chair, and tied to it with numerous strappings. The electrode (the end of the wire) of the positive current was attached to the forehead by means of a brass band made to fit the head, with a sponge placed on the underside, while the negative electrode, with a similar apparatus, was fastened to the left leg in one case, but to the right legs of the others. A current of from 1,500 to 2,000 volts was administered, and death was instantaneous, but the current was turned on a sec-time in each case, to make sure life was completely put out.

DEATH came by electricity, on Friday night of last week, to three students of Woodstock College, Maryland, while they were going to bed. They were among a number of the students who were enjoying their annual holiday at St. Inigoe's Villa. A heavy thunderstorm was raging when they retired to their rooms. A number went to the dormitory on the top floor. The roof was leaking, and the beds were moved to the center of the room which was dry. While thus grouped, and discussing the situation, the lightning came into their midst, killing three (without a second application), and hurling the others in various directions in a state of semi-consciousness.

A TERRIBLE EXPLOSION AGAIN.

A communication from White Haven, Pa., dated June 30, says:

The boiler of shifting engine No. 235 on the Central railroad of New Jersey exploded last night near Nesquehoning Junction.

Engineer Thomas Tripp, of Mauch Chunk, Fireman J. Pope, of Linsford, and Brakemen Gallagher and Smith, of Mauch Chunk, were instantly killed.

The body of Engineer Tripp was crushed in a terrible manner and was found a hundred yards from where the explosion occurred. No trace of Fireman Pope's body has yet been found and it is thought he was blown to atoms.

The locomotive was totally wrecked, the boiler being blown 100 feet up the mountain side. There was some defect in the water pipe. As the engineer neared Nesquehoning the fire in the engine was dying out and vapor was noticed issuing from the fire box. Fireman Pope had just descended from the cab for the purpose of examining the boiler, when the explosion occurred.

THE SUPREME COUNCIL MEETING.

"All of the Councils who have not reported, should do so before Monday, July 13," says Bro. Arthur Kassing, grand corresponding engineer, State of New York. "From reports I have received," says he, "the Order is in first-class condition in New York State."

Delegates from the West, who pass through Chicago, are invited to call at the office of the AMERICAN ENGINEER, if they can do so before noon today (Saturday), so that we may go together as much as possible. From what we are informed, we expect there will be a good representation of the A. O. S. E. at Syracuse the coming week. The manufacturers of steam engines, boilers, pumps, heaters, and steam appliances generally will also be represented quite strongly at the Engineers' Fair or Exhibition.

Among the distinguished men who are expected to attend are Governor Hill, the Mayor of Syracuse, Prof. Thurstou, Prof. Sweet, etc. And, taking it altogether, it promises to be the greatest and most important gathering the Order has yet held.

"THE FOUNDER OF MODERN ELECTRICITY."

Humphrey Davy made important discoveries, uot the least being his discovery of Michael Faraday. The centenary of the birth of Faraday has been celebrated in London by two lectures at the Royal Institution. The first was by Lord Rayleigh, who said that, fired by contact with the genius of Davy, he (Faraday) volunteered his services in the laboratory of the Institution. After referring to the sketch of Faraday by Prof. Tyndall, who is now a hetpless invalid, the lecturer remarked that of Faraday's great achievements, whether they had regard to fundamental scientific import, or to practical results, the first place must undoubtedly be assigned to the great discovery of the induction of electrical currents. In December, 1824, Faraday attempted to obtain an electric current by means of a magnet, and on three occasions he had made elaborate, but uusuccessful attempts to produce a current in one wire by means of a current in another wire, or by a magnet. He still persevered, and on the 29th of August, 1831, he obtained the first evidence that an electric current could induce another in a different circuit. On September 23rd he wrote to his friend, R. Phillips:—"I am busy just uow again on electromagnetism, and think I have got hold of a good thing, but can't say. It may be a weed instead of a fish that, after all my labor, I may at last pull up."

Having proved the complete identity of the electricity in lightning with that in the voltaic cell, he abandoned the term "pole" for "electrode," and considered the expression "electric fluid" a dangerous one. It was, indeed, a term which, as Maxwell observed, ought to be banished to the region of newspaper paragraphs.

Diamaguetism was another subject for the researches of Faraday which had been more fully developed by Sir William Thomson.

Faraday had made one singular remark as to a particular formation of waves generated under the action of wind, which the lecturer had himself, after patient observation for half an hour or three-quarters of an hour, verified at a French watering place. He was disposed to doubt whether anybody else save Faraday and himself had ever noticed that phenomenon. But it was one thing to have discovered, and quite another to have verified the discovery once made. The philosopher had also made a number of minor observations of great value, and he was reminded of one by a recent lamentable accident caused by the breaking of a paraffin lamp. Faraday had shown a method of holding the breath for a prolonged time by means of successive deep inspirations and expirations, which, if practiced, might have proved of saving worth on that sad occasiou.

The question had often been discussed what effect on Faraday's carcer would have been produced if he had been subjected to a mathematical training. They must all feel that they would not have wished him to be other than he was. But if the question must be discussed it would have to be admitted that, by such a training, he would have been placed in more thorough *rapport* with his scientific contemporaries. But mathematical training and mathematical capacity were different things, and it did not follow that Faraday had not a mathematical mind. In Prof. Clerk Maxwell's opinion Faraday had mathematical powers of a very high order, from which it he had devoted himself to that science, valuable and fertile methods might have been discovered by him.

THE DAUGHTERS OF FULTON.

ROCHESTER (N. Y.) AUXILIARY.

The Rochester Auxiliary, No. 2 New York State, of the Daughters of Fulton, gave a very successful musical and literary entertainment the last Thursday evening in June, in the K. of P. hall. There was a large attendance, and a fine programme was well rendered. The organization is growing wonderfully. They are hustlers, and promise a lively time the coming winter. They will be an auxiliary to Rochester No. 8 A. O. S. E. in every sense of the word. The following are the officers so far elected:—

Past Matron, Mrs. Jos. Redfern.
Matron, Mrs. J. B. Swearing.
Junior Matron, Mrs. John Aitken.
Treasurer, Mrs. Geo. Eldridge.
Outside Sentinel, Miss Frankie Swearing.
Inside Sentinel, Mrs. Peter Webber.

EDISON'S LATEST RIVAL.

Mr. Rudge, of Bristol, to whom we alluded the other week, says the *Electrical Engineer*, (London), does not seem to be the only one who has forestalled Edison's "kinetograph." Mr. Jebus Bickle, of Plymouth, writing to the *Western Morning News*, says: "Your readers will, no doubt, be interested to learn that Edison's invention is not a novel one, as provisional protection was granted to J. B. King and Jebus Bickle for a similar camera in January last. In this camera ordinary dry plates are used, and placed in the camera in 'dark slides' in the usual manner. By use of suitable mechanism, operated by clockwork on an electric motor, a series of pictures are produced about $\frac{3}{8}$in. diameter of moving objects, in rapid succession, until the cycle motion is completed. The plates are developed in the ordinary way; positives are produced as lantern slides, when, by means of proper lenses and suitable illumination, the camera can be used as a lantern, and the objects thrown on a screen, giving the exact appearance of objects in motion. Although I do not hope to claim for this camera, which I have called the 'lorgraphoscope,' all that the great American inventor has done, yet I venture to say it will play an important part in the amusement and instruction of the rising generation."

ELECTRICITY.

II.—THE FLUID AND OTHER THEORIES.

The photographer of to-day talks, in connection with his art, of "handicapping molecules" by mixing gums with bromide of silver, "in order that their rate of vibration may be affected by the long waves of energy." And a scientific contemporary asks, Shall we not have the means of obtaining the mechanical equivalent of such handicapped vibrations?

A paper was recently read before the Chicago Electric Club on the present theories concerning the nature of electricity. But we fail to find any theory better than, or even equal to, that of vibrations. or the waves theory. As Prof. Edwin Houston says, the single and double fluid theories are now generally discarded. No less a scientist than Dr. Benjamin Franklin advocated the single fluid theory. And the Royal Society (London) followed this theory for all there was in it. They conducted numerous experiments, under the guidance of Sir William Watson, to try to ascertain "the velocity of the electric fluid." They decided that its velocity was "instantaneous." It was this same Watson who suggested the idea of positive and negative electricity, which was more tellingly presented by Franklin. About a century before them M. Dufay had described vitreous and resinous electricity, the vitreous being the positive (commonly designated by the sign +), and the resinous being the negative (expressed by the sign —). We will explain presently why the one supposed kind is characterised plus (+), and called vitreous or positive, while the other is marked minus (—), and called resinous or negative electricity.

The original way of developing electrical phenomenon was by rubbing amber, which is a resinous substance, and when rubbed attracted light bodies, or, in other words, developed negative (—) electricity. The Greek word for amber is *elektron*, the root of which means to draw. And from this term the word electricity has been derived. Thales of Miletus, Ionia, who lived about six centuries before the Christian era, is said to have explained how amber, when rubbed, attracted (or repelled) light bodies. Theophrastus, about three hundred years later, as well as Pliny, in the latter half of our first century, both mention the power of amber to attract straws and dry leaves.

It appears, however, that men possessed a knowledge of magnetism long before then. And the drawing power of amber, "when a vivifying heat is applied to it," was supposed to be nearly related to the power of the magnet to attract iron. The first hypothesis advanced with the view to explaining the phenomena of electrical attraction was that of Nicholas Cabæus (A. D. 1629), who thought "rays of unctuous steams," thrown out by such substances as rubbed amber, expelled the surrounding air, "making small whirlwind," and in returning carried the light bodies with it. This was generally accepted for a time. And Pierre Gassendi (A. D. 1632) said "these electrical rays get into the pores of a straw, and by means of their decussion take the faster hold of it," and then "shrink back to the amber whence they were emitted," carrying the straw with them.

Dr. Gilbert, of Colchester, who lived between 1540 and 1603 A. D., that is during the long reign of Queen Elizabeth, made important discoveries, and opened the door to the great field of electrical investigations in which many talented discoverers have since labored. Gilbert ascertained that a host of other substances, beside amber, possess the force to attract light substances. He also found that dryness of the atmosphere, with north or east wind, is a favorable condition for electrical development; while moisture, with south wind, is unfavorable.

A simple method of experimenting with the attractive quality of electricity is to take a piece of sealing-wax, and after rubbing it violently, on cloth or flannel, hold it near some small scraps of paper, which will be attracted to the wax.

Another plan is to take a glass tube, say half or three-fourths of an inch in diameter, and rub it with a piece of silk. Then it will attract light bodies, like the sealing-wax or amber, but as soon as they have touched the glass tube they fly from it. Glass is a vitreous substance, and the result of rubbing such a body is vitreous or positive (+) electricity.

Pieces of glass tubing are very useful in making electrical experiments. Pieces of various sizes may be obtained from scientific instrument-makers at small cost. The way to cut a glass tube to any required length is to make a slight groove, with a triangular file, at the desired point, and it will snap off easily. The ends may be rounded off by holding them in a gas flame. By smearing some electrical amalgam on the silk rubber, the effect will be greatly increased. This amalgam is a compound of mercury, tin, and zinc, in the proportion of one part tin, two parts zinc, and six parts mercury; or tin 1, zinc 1, and mercury 2 parts. The tin and zinc should be melted together in an iron ladle, and then poured with the mercury into a wooden box well rubbed with chalk, and the whole shaken till it cools. Care must be taken that the mercury does not spirt about when mixed with the hot metal. When cold, the amalgam may be pounded, and smeared on the silk when mixed up with lard.

When a glass tube is excited in that way, a faint crackling noise will be heard, when we draw the finger along close to the tube, and in the dark sparks may be observed. If we bring the tube, after it is well rubbed, close to the face, a sensation as if we were in contact with cobwebs will be experienced, combined with a slight smell as of burning sulphur. And if we rub together two pieces of quartz, in the dark, similar light and odor will be observed. Similar effects may be produced by other means. If, on a frosty night, we take up a black cat, after it has become warm by lying in front of a fire, and stroke it, we shall see and hear small sparks coming from its hair; and by holding one hand near its neck, and passing the other gently along its back, slight shocks may be felt. And some people who have dry hair can produce similar results when they brush it vigorously.

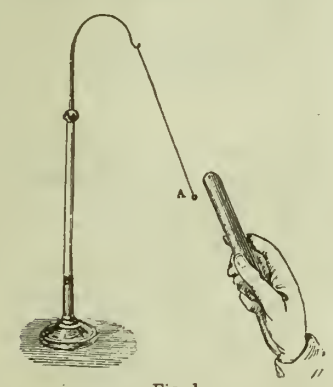

Fig. 1.

The simplest method of demonstrating the development of that mysterious something called electricity is by means of the electric pendulum, shown in Fig. 1. This contrivance is familiar to all students who have taken elementary lessons in electricity.

And we know of no better scheme to enable beginners to "catch on" to the strings of electrical knowledge. It can be put up at a small cost. A piece of glass tube, ten or twelve inches long, is fixed vertically in a small stand; a wooden cap is fixed to the top of the tube, in which a bent piece of wire is inserted. At the other end of the wire is a hook, as shown in the electrotype. A piece of silk thread is attached to the hook, and to the bottom end of the thread is fixed a little ball, A, cut out of the pith of the elder. This elder pith is chosen on account of its extreme lightness. And it is easily shaved round into ball form.

If a glass support is not at hand, a piece of wire may be used instead, that is a wire all the way from the stand, bent over at the top, and with a hook at the end to hold the silk thread to which the ball is attached. But the all-wire pendulum holder does not answer the purpose so well as one with a glass trunk.

The ball A, will stand perpendicularly under the hook which holds the silk thread, of course, unless something causes it to lean to one side. Now, if a glass tube is rubbed with silk (and if the silk is smeared with the amalgam which has been mentioned, all the better), and if the tube is then held near the ball, it will be seen that the ball will immediately move towards the excited tube, as shown in the illustration. But as soon as the ball has touched the tube, the electricity (in the tube) is shared between them,—at least that is the theory,—and the ball now moves back as rapidly as it came towards the tube. Then, again, if two balls, placed nearly together and each mounted as shown in Fig. 1, be allowed to touch the tube, not only will the tube repel the balls, but the balls also will repel each other. The balls may be on one or on separate hooks.

The theory is, as just mentioned, that the excited glass tube charges the two balls with vitreous or positive (+) electricity. And substances overfilled with the same kind of electricity always repell each other; they attract only substances that have less or different electricity, according to theory. Now, if an excited (rubbed) stick of sealing wax be brought near the pith balls when charged by the glass tube, it will be found that the balls while repelled by the glas tube) will be attracted towards the sealing wax. The resinous or negative (—) electricity of the sealing wax draws the positive electricity in the balls which they received from the glass tube.

It is still more remarkable that two balls mounted on separate stands, and both charged with electricity from the sealing wax, will repel each other; but if one ball is excited by the sealing wax, and the other by the glass tube, instead of repelling, the balls will attract each other.

According to the Franklin, or one fluid theory, all bodies or substances naturally possess a certain quantity. Let it be supposed that this imaginary fluid is the same as what others call ether. Now all things in creation possess some of this something, whether we call it ether, or electric fluid, or electricity. When everything is in a normal state, there is no disturbance of this universal something. But when one substance gets more than its regular share, it is positively electrified, and that is how the plus sign (+) came to be used to designate positive electricity; but if a substance loses a part of its legitimate quantity, and possesses less than its regular share, then it is negatively electrified, hence the minus sign (—) is used to designate negative electricity.

The theorists who speak of two kinds of electricity (instead of a fluid) say that the two kinds, negative and positive, neutralize each other, when naturally associated in one body, and in this state electricity pervades all things. But if this state of things be disturbed, by friction or otherwise, the something called electricity (or universal fluid) is decomposed, so to speak, and one kind will leave the substance where the two kinds dwelt together, and pass into another, while the opposite kind remains in its original place. Which kind remains in the substance may be determined by bringing it near the pith ball. If the ball is charged +, it will be attracted by bodies excited —, and just the reverse the other way. It should be remembered that it is opposites that attract each other. And when two bodies are rubbed together, so as to produce electrical effects, one is positively electrified, while the other is electrified negatively. Thus, when a glass tube is rubbed with a piece of silk, the glass gathers up the positive electricity from the silk and becomes positively electrified, while the silk is charged with negative electricity. Both of the bodies coming in contact with each other are thus electrically excited.

The question of insulation should be referred to here. The glass tube holds something that it has received from the silk, but gives up some of it to the pith ball. If a wire is near the ball, it will lose this something rapidly. Or if a finger touches the ball, its electricity will disappear at once. Electricity will readily pass along the metals and other substances, and escape. These are termed "conductors," in the vocabulary of electrical science. Glass and sulphur and other substances will confine electrical energy and prevent it from escaping, and they are therefore designated "insulators" or "non-conductors." It is to be noted, however, that no conductor is capable of taking all the electrical current along, neither is there any absolutely perfect "insulator."

As already intimated, moisture is unfavorable for electrical manifestations. Moisture (like water) is a good conductor. This is a reason why the United States, with their comparatively dry atmosphere, have been far more favorable for the development of electrical industries than John Bull's tight little island, with its moist atmosphere. A room full of people is liable to have its air moistened that elec-

trical experiments may become failures (from that cause), unless means are taken to preserve dryness around the electrical apparatus (even the electrical pendulum).

Another reason why the United States have led the world in the development of applied electricity is that the American spirit of progress has carried our leading electricians into the practical and useful side, instead of letting them stick at theories too much. As stated by Prof. John Trowbridge, of Harvard College,—

"Out of all the theories of electricity, the two-fluid theories, the one-fluid or Franklin theory, and the various molecular theories, not one remains to-day under the guidance of which we are ready to march onward. We have discovered that we cannot speak of the velocity of electricity. All that we can truly say is, we have a healthy distrust of our theories, and an abiding faith in the doctrine of the conservation of energy. We shall probably never know what electricity is, any more than we know what energy is. What we shall be able, probaby, to discover, is the relationship between electricity, magnetism, light, heat, gravitation, and the attracting force which manifests itself in chemical changes."

The electricians who have experimented, and investigated, until they have designed the electric machines now in practical operation, on a commercial basis, have reduced their knowledge of electricity and magnetism to what may be called a mechanical system, and they are to-day well able to calculate before hand, in a large number of cases, what will take place under certain conditions. They can decide on the form and size of a dynamo for any specific work, and have the plans drawn as accurately and with as much certainty (as to the result) as the diagrams of a steam engine are constructed. And we may congratulate our readers, as well as ourselves, on the fact that there is a great deal of systematic knowledge concerning electricity within easy reach of all who seek it at the present day. And it is as easy to become a working electrician as it is to become a practical engineer. The necessary initial knowledge is systematized in either case; and our chief mission, in these articles, is to present the information that is requisite and useful for a man who wants to prepare himself to take charge of, and operate an electric plant. Those who wish to pursue their studies on a higher level, and want to become something more than a working electrician, must seek the help of a laboratory and consult the standard authors on the various branches of electrical science. And it may be well to remark that in order to acquire a first-class systematic knowledge concerning applied electricity, and master the whole science, a man must make himself familiar with thermo-dynamics, with analytical mechanics, and with most of the topics now embraced under the comprehensive name of "physics."

FORCE TRANSMITTED BY ELECTRICITY.

Since it was only as far back as 1873 (at the Vienna Universal Exposition) that the transmissibility of force by electricity was accidentally discovered, the progress so far made in this business is very wonderful. From a central station, force is transmitted by means of the electric current to any distance, or, to be strictly accurate, the generator at the central station connected to motors at various distances, by means of electric conductors, makes those motors develop power at the place it is wanted. The advantages of obtaining power in that way are very important and numerous.

Mr. A. M. Tanner writes as follows in the London *Electrical Review*, showing that Alexander Bessolo was the original inventor of the transmission of force by electricity, and of an electric railway with overhead conductor.

For some time it has been known to the writer that a French patent, issued in the name of Henry Gilbee on the 16th day of January, 1855, No. 22,114, contains a description of a method of transmitting force by electricity, and the employment of electric motors for the propulsion of cars on railways, the track rails and an overhead conductor being used to convey the current. Upon examining the original documents of the patent in question it soon became apparent that some person other than the patentee was the inventor of the various forms of electric motors and special uses thereof as described in the patent and its two certificates of addition. This opinion was strengthened by the fact that an English patent, No. 148, of 1855, issued in the name of de Fontaine-Moreau, and substantially embracing the subject matter of the first certificate of addition of the French patent of Gilbee, is stated to be "a communication." As Gilbee figured in the original French documents as the *employe* of the patent agent who took out the English patent, it became necessary to find the real inventor of the subject-matter set forth in the French patent. Lithograph drawings filed with the patent application were undoubtedly made in Italy, as they bear the names of the Italian draughtsmen and address of the lithographer in Turin. A slight clue as to the identity of the inventor was obtained when the name "Bessolo" was noticed written in lead pencil on the patent document. The writer then remembered that a French engineer, several years ago, stated in a discourse on the transmission of force by electricity that one Bessolo, and not Gramme, was the discoverer of the transmission of force by electricity. The source of information, however, was not given, and it was thought by the writer that no published description existed of the Bessolo invention.

The pencil-written name on the French patent was taken up as a clue, and enquiry in various places soon revealed the real facts of the case, and the writer was permitted to see a document on file in the secret archives of the Conservatoire Nationales des Arts et Metiers.

The following is a copy of the document in question, which is said to have been deposited by Alexander Bessolo on the 26th day of October, 1883.

[COPY.]

I, Henry Gilbee, of No. 9, Sackville Street, Piccadilly, London, son of the late William and Charlotte Gilbee, born in London in the year 1831, do solemnly and sincerely declare that in the year 1855, when I was employed in the Patent Office of the late Peter Armand Le Comte de Fontaine-Moreau, brother-in-law of my mother, at Paris, 39, Rue de l'Exchiquier, I took out, by order of him, in my name, under the title of "System de moteur electrique," a French patent dated January 19th, 1855, and also a Belgian patent dated January 22nd, 1855, which invention I fully believe Mr. Bessolo (Cavaliere) Alexander, late Peter, born at Corea, Italy, at present retired major, to be the inventor and author, and I further declare that Mr. Bessolo, in the commencement of the year 1855, gave orders to the said Patent Office in Paris to take out the patents in the countries before mentioned under the title of "Moteur electro magnetique rotatoire a reaction entre le fer," for which purpose he sent the description and two lithographed drawings, marked A and B, and a special procuration to take out in my name French and Belgian patents, on the condition that afterwards I would transfer the said patents to him. I further declare that the sheets of drawings marked A and A′, B B′, have been respectively lithographed on the same stone as sheets A and B, and that I deposited them at the French and Belgium Patent Offices in order to confirm that I received the above from him. I further declare that I saw the autographic pamphlets marked C, and the two manuscripts marked D and E (the first was a copy) frequently in the hands of Mr. Bessolo between the months of May and July, 1855, at the said Patent Office in Paris, for the purpose of preparing the definite description. I therefore make this declaration to justify Mr. Bessolo as being the author of the said invention, and that I merely took them out by his procuration, and I make this solemn declaration conscientiously believing the same to be true and by virtue of the provisions of the statutory delarations October, 1835.

(Signed) H Gilbee.

Subscribed and declared at the Mansion House, in the City of London, this 17th day of October, 1883.

(Signed) Henry Knight,
Lord Mayor London.

Here follow legalisations of the Lord Mayor's signature by the Italian Consul General at London, and then the Director of the Conservatoire des Arts et Metiers certifies that the copy of the affidavit left at his bureau is like the original seen by him.

Having now conclusively established the fact that Alexander Bessolo was the real inventor of the subject matter contained in the patent taken out in France in the name of Gilbee, I will now review the second certificate of addition of said patent, which in unmistakeable language contains a description of the transmission of force by electricity. I will give the description in the original, and then a free translation, as follows, vfz:

Transmission a distance. Dans le cas ou l'on besoin du travail d'un moteur quelconque a une certaine distance de l'emplacement de ce dernier on emploiera la force dont on dispose a faire mouvoir directement une machine magneto electrique qui au moyen de fils telegraphiques communique le courant a une moteur electro magnetique. Ainsi dans le percement des montagnes on profiterait des chutes d'eau ou de vent pour mettre en mouvement une on plusicurs machines magneto electriques qui communiqueraient leur courant a un moteur electromagnetique mis en rapport avec la machine outil executant le percement et placee dans le galerie meme.

Transmission to a distance.—In the case where there is need of the work of any motor at a certain distance from the point of location of the latter, the force is employed to direcely operate a magneto-electric machine, which by means of telegraph wires conveys the current to an electro-magnetic motor. Thus, for example, in tunneling mountains waterfalls and the wind are utilized for setting in motion one or several magneto-electric machines, which communicate their current to an electro-magnetic motor directly connected with the boring machine, and located in the gallery itself."

It is needless to say that Gramme and his coworker Fontaine cannot, in view of the foregoing description, maintain the claim that they were the first to propose the transmission of force by electricity at the Vienna Exposition of 1873. Another portion of the description in the second certificate of addition of the Bessolo patent, obtained through the procuration of Gilbee, will now be considered. Many uses of the patented electric motor are referred to, such as driving screw propellers, ventilating fans, aerial ships, and submarine boats, but the most important feature is where the propulsion of cars on railways is referred to. After disclaiming the use of batteries carried by the car, it is stated that "batteries are located at the different stations and the electric current from the same is conveyed to the electro-motor locomotive by the rails and a conductor insulated from the ground and supported on poles in a manner analogous to telegraph wires, which might even be supported on the same poles. The adherence is ensured by the electro-magnetic attraction exerted between the wheels and the rails, or by the solidity of pairs of wheels of one or several vehicles when they are connected by means of cords, chains or belts." The description is silent as to a travelling connection between the electric motor on the car and the overhead conductor; but obviously such a connection was contemplated by the inventor, and the description thereof was left out by inadvertence, and not because it was not understood that a travelling connection had to be provided between the overhead conductor and the motor on the car. It will, of course, be held that a published description, in order to defeat a patent, must be clear, and in such terms as to enable any one skilled in the art to make and use the invention described. Viewed in this light, the French patent might not be sufficient to stand a judicial test as a bar to the validity of a patent claiming broadly the electric railway system with an overhead conductor and travelling connection supplying the current to the car motor. This article, however, is not a legal argument, and does not pretend to be anything but a review of the inventions of a meritorious inventor who had a clear conception of the transmission of force by electricity and a railway system with an overhead conductor in what has been termed the infant age of electricity. It has been ascertained by the writer, but not yet confirmed by personal investigation, that an Austrian patent, granted to Alexander Bessolo on the 3rd day of December, 1855, is for an electro-magnetic motor, and applications thereof, in which is found a description of the travelling connection between the overhead conductor and the car motor.

P. S.—Since writing the foregoing article, the discovery has been made that *La Lumiere Electrique*, of December 8th, 1883, contains an illustrated article concerning Bessolo's French patent. The subject, however, is not treated in the same way as by the present writer, and the bearing of the patent upon the transmission of force by electricity on railways is not brought into the foreground.

THE PROFESSION OF AN ENGINEER.

In an editorial on "What an Engineer Should Be," our London contemporary, *The Engineer*, very properly points out that pure animal courage, nerve, pluck, not moral courage, is one of the endowments essential to success in this profession. This is a personal characteristic not usually recognized in summing up the career of an engineer, who has made his mark in the world, but that our contemporary is right every member of the profession will admit from the evidence of his own experience or that of his fellow engineers. As a profession, engineering, in this respect, can be best compared with the calling of the soldier or sailor, in whose life events continually occur that demand the extreme of personal pluck, readiness of resource, and that determination and tact that make a man a leader among men, and compel obedience. An engineer may theoretically know how to meet an emergency, and in his office figure out all the details of his plan and feel assured of successful results. But if he cannot meet this emergency on the spot and if necessary lead his men under conditions that may sometimes mean death to all concerned, his theoretical knowledge and finished training are practically of no avail, and the man lacks that essential something that means the difference between failure and success. No timid, hesitating man can ever be a great engineer.

Another essential in the personality of an engineer not commented upon by our contemporary is tact, or the natural instinct for reading character, and adapting words and actions to circumstances, and thus knowing how to deal with men. Many a good man otherwise has failed to attain success simply because he was constantly, but unintentionally, at odds with his masters or his servants. While many another man with comparatively little other help than his own shrewdness in reading men, and the faculty of pleasing those above and below him, has accomplished honorable results. In these comparisons on a basis of personality it is assumed, of course, that other things are fairly equal; but it is safe to say that the quick, bright young man, who is popular with his superiors, and is obeyed by his subordinates for his own sake, will outstrip in the race for preferment the plodding student who holds himself aloof from his associates on all sides and simply strives to do his duty and no more. As a very general rule, the successful engineer is also popular as a man.

In treating of the difficulty met with by parents in selecting a career for their sons, *The Engineer* closes the editorial referred to with the very level-headed advice —"to take little or no thought for the special proclivities of the youth, but put him into that branch of the profession in which you have the most interest." This will hardly accord with the views of some parents, who in their pride feel assured that their boy is "smart" enough to make his way anywhere; and assume that because the heir of the house can make a crude sketch of a locomotive, for example—usually with the smoke flying the wrong way—that he is destined by nature to improve upon all past practice in this line and to astonish the world as a mechanical engineer. Influence is just as powerful in the engineering profession as in politics; and the young man is not wise who abandons a field in which he can command the aid and backing of older and influential men, for one which he must till alone. He may succeed in the latter, and many do; but the average young man advances faster when he has some one to help him.—*Engineering News.*

The advice quoted above, and described by our New York contemporary as "level-headed," is open for improvement. We would say, "Put your son into that profession in which you have the most interest—if he seems to take to it, and appears well adapted for it." History is full of examples of the folly of forcing a youth to follow a certain trade or calling, if his proclivities are strongly bent in another direction. We need mention but one striking example, that of Linnæus, the celebrated botanist, whose father utterly failed to make a preacher of him.

A report of the Supreme Council meeting will appear in our next issue.

CORRESPONDENCE.

Corliss and Slide Valve

To the Editor of the American Engineer:

Sir:—The recording engineer of Kensington Council, No. 3, Pa., is after me I see. Well, it took him a long while to wake up, did it not? And is he the only friend the Corliss engine has among all your thousands of readers? After my attack on the so-called automatic valve motion of the day only one, yes, just one of the many who run those automatics have the pluck to come out in their defense. Well, Mr. Recorder, I admire your pluck; but it is of no use. You dodge again. I want you to give a full description of your plant, boiler, engine, and work done by them; send the editor of The American Engineer some of your cards, the size of your engine, number of revolutions, steam pressure, etc. Give me full data, and see where you will land. That old slide valve that recorder speaks of simply needs a new engineer, one who *understands* a slide valve. I don't run my old 18x36 gal in that fashion. Listen to this: I get her along at 86 revolution, carry 100 lbs. steam, and get a M. E. P. of over 60 lbs. I don't carry steam half stroke, guess I have got a new style of lap.

The boss had seven engineers in one year when I took hold; they had run her 40 revolutions, and carried 60 lbs. steam. The boys gave me one week to stay; I am there yet, speeded the old gal up, found my boiler was a dandy, crowded on steam to 100 lbs. They smiled to see old slide valve get along.

Second week saved one ton of coal per day, third week got it to one and a half ton per day, coal cost $4.50 per ton, saved the boss $6.75 per day; *same engine, new engineer.*

Don't want to boast, recorder, but want to tell you there is a big difference who runs the engines, ain't there?

Going to celebrate her birthday next week. The old gal is 39 years old; guess I will give her a new coat (of paint) and trim her up with stars and stripes.

She has done nobly, and cost nothing for repairs, and not over 5 per cent in fuel over your new fangled automatic, "which valve gear is so constructed that it leads to great inconvenience and annoyance from its parts wearing loose and becoming shaky. The effect of the action of the releasing gear is to disturb the governor. The latter is the most serious fault, because its tendency is to impair the regulation, preventing its being brought to that degree of perfection which is desirable in a perfect governor."

See, I am giving you some simple facts, quoted from "Edwards."

Now, dear recorder, while you are worrying your life short watching valve gear, dash pots, a governor that don't govern, and all the rest of your new fangled truck, I am sitting with nothing to worry, going home at night feeling certain I will find my old gal all right in the morning; can go to church Sundays with my wife, don't have to get up as you do and go down to the engine room and put in a whole day working on the fancy built *darling* who is all feathers and frills, so that she may be kept going one more week.

No, Mr. Editor, Old Slide Valve is O. K., and I ain't no fool if I do run a common old fashioned style engine. I still remain yours truly,

Old Slide Valve.

John E. Sweet Council, No. 6, N. Y.

To the Editor of the American Engineer.

Sir:—By order of the Grand Chief, State of New York, the John E. Sweet Council, No. 6, send the following announcement for publication:

Expelled Members.

Lewis Gatti, Howard Cheuy.

Suspended for Arrears in Dues.

James B. Taylor, A. C. Wood, J. W. Vanpatten, W. S. Thompson, James McKensay, H. J. Spencer, M. J. Dunn.

If these suspended members pay up, the names of each one (as they settle) will be published clear.

W. A. Gleave, Cor. Engineer.

Keeler Council, No. 4, N. Y.

To the Editor of the American Engineer:

Sir:—There was no meeting of Keeler Council last Saturday night, as all the members, in common with the rest of the loyal citizens of Utica, were celebrating the Glorious Fourth. We are getting along in good shape. We initiated a new member last month, and there are several who are waiting to come in.

Bro. Geo. Cone met with a severe, and nearly fatal accident at Richfield Spa, on Saturday, June 27. He is at St. Elizabeth's hospital, where he will receive the best of care. He has the sympathy of all the brothers.

Bro. Hugh Roberts has gone to Richfield for the season.

K. A.

Valley City, No. 2, Mich.

To the Editor of the American Engineer:

Sir:—We are still gaining strength—engineers still making application for membership. We are trying to make our meetings interesting, and expect, in the near future, to see every member in attendance who possibly can. Bros. Moore, Emons, and Jordon, needed no introduction, although their faces were somewhat—strange. Well, business, new smoke stacks, new plants, &c. The reason Bro. Bates is the busiest man in town, his plant, at the Hydraulic Pump Works burnt down lately. He has no "a very large engine room, the sky for his roof and neighboring lots constitute the room. To show what metal he was made of, in 40 hours he was pumping water as usual. Bro. Gifford was in his chair. We all knew it, because he brought a number of fans, I suppose to keep the boys from censuring him for "none" atte—. The fans were appreciated; he may bring a wind mill next time.

Election of Officers.

Our ticket, as elected, is as follows:—

C. E., Stephen Christie.
F. A. E., Geo. R. Devoe.
Recording E., J. H. Gifford.
Corres. E., C. M. Baker.
Fin. E., E. Emons.
Trea. E., Wm. Beck.
Chaplain, John Moore.
Sen. M. M., Chas. Dickinson.
J. M. M., Gordon Jones.
M. S., J. A. Angus.
O. S., H. E. Colton.
Trustees, Luke Vickerman, Peter Rejnbal.

Bro. Beck is still a very sick man; has been confined to his bed for 2 weeks; reported improving. Will in future publish names of those members who insist on keeping from the meetings; none of our members out of employment.

Stephen Christie.

Council Bluffs, No. 2, Iowa.

To the Editor of The American Engineer:

Sir:—We are a young council, having been organized but three weeks ago. You have already heard, that David Gilbert Council, No. 2, of Omaha is the cause of our existence. We are glad of it, and hope that Omaha No. 2, will never have cause to be ashamed of their "baby," as they choose to call us at first. We are by no means small now, in fact we are growing wonderfully, our list of membership will soon be running up against thirty.

I will say this much for Omaha No. 2, that its leaders are first-class hustlers and to them belongs the glory of bringing the Bluffs boys together, which, I can assure you, was no easy task. Several attempts have been made time and again by the older engineers to organize *something*, and invitations have been made to the National Order of Steam Engineers to come over and establish a subordinate council, but the task proved, from some cause or other, to be a hopeless one, until the A. O. S. E. took the matter in hand and pushed it right through.

David Gilbert Council does not seem to be satisfied with starting us, and then drop us and let us go on, they very pleasantly surprised us last Saturday night, when about half of the Omaha No. 2 boys cross the river and took us all unawares (except Bro. Burke who would not give it away.) Old father Gilbert; was there, and Omaha's genial chief, Cooper, and Lennox and his yellow dog, and the young Gilberts and well, I believe you would not let me have space enough in your paper to name them all, because there were about fifty of them. We tried to make it as enjoyable as the hot weather would allow.

We had two candidates to initiate, and speeches were made by the wholesale; the one made by Chief Cooper on "The Drunken Engineer," was received with much enthusiasm.

We are getting into shape now, and settling down to the regular order of business, and have ordered a blackboard made, which we will put into frequent use. Bro. Kramer claims he is going to show us how to draw the saturation curve offhand the first night we get it up. Bro. Chapman is going to explain how compression can be done to the best advantage, after all the steam is exhausted from the cylinder. There's an awful lot of more things we are going to tackle; but I had better not get too previous.

No doubt we are all going to pull together and keep the ball rolling, and let us never forget that we are working for the good of the A. O. S. E. and the working engineer. C. M. A.

St. Clair Council, No 5, Ill.

To the Editor of the American Engineer:

SIR:—As this is the first time I have had the privilege of addressing you, should there be any mistakes I hope you will look them over.

I should have performed this duty some time ago, but I have had so much to think about I could not do all without making some mistakes.

I have to inform you that on June 7th we admitted four new members.

We are getting along fine; will write again. Yours fraternally, etc. BARNEY SOWMAN.

Cor. Engr., No. 605 South St., Belleville, Ills.

The Bowling Green Rapid Transit Idea.

To the Editor of the American Engineer:

SIR:—I thank you for your kindly mention and insertion of my railroad plan. You are correct as to friction, but I suppose that the Weems Electric Express uses small wheels.

Compare a car wheel 33 inches in diameter and one 99 inches, both revolve the same number of times per minute, the large wheel will go three times as far as the small one in the same time with the same friction, provided that the large wheel does not bind with side draft. So, should large wheels be used under our cars, we could travel three times as fast as now with no more friction.

Give us this road for the World's Fair.

Very truly yours,
M. E. WOODBURY.

Ah, That Boiler.

To the Editor of the American Engineer:

SIR:—Among the abuses of boilers may be mentioned, (1) incrustation; (2) corrosion; (3) defective pressure gauges; (4) the use of compound lever safety valves.

Out of twelve pressure gauges which I have tested during the last eighteen months, I did not find one that was correct; the nearest to correct was six pounds out; the worst was twenty-eight pounds out. In the majority of cases they were out in the wrong direction to render safety to the boiler and attendant. How many engineers are there that do not know whether their gauges are correct or not?

Ah, yes, I will tell you about the compound lever safety valve, before I forget it. It consists of a common ball and lever with an attachment; this attachment consists of a piece of one-inch gas pipe about eight feet long which is laid on the end of the safety valve lever and under a beam about twelve inches away, thus making a compound lever. I recently went into a small plant where I saw this kind of an arrangement at work. I asked a boy, who was shoveling in coal, where the engineer was. He said they didn't have any. Then I took a walk.

In my opinion, the four abuses above mentioned, are the causes of more boiler explosions than all other causes put together. Respectfully yours,

AIR BRAKE.

What Are You Using?

To the Editor of the American Engineer:

SIR:—The late great Barnum, the showman, said that American people like to be humbugged, and it is a known fact that some people humbug themselves, and they seem to enjoy it. They call it confidence, or reliance; fiction is real with them, and seems to be established facts, but it is only after spending many dollars that they realize it is only humbug after all.

In engineering it is in the use or purchase of compounds, the most noticeable. Without any question of doubt there are compounds that are beneficial to boilers, that they save their worth in fuel many times, and that there are localities where they cannot be dispensed with. But, like every good article, they are imitated in appearance whether it be solid or liquid form. Often these imitations, instead of being beneficial, are injurious, and there are many cases when boilers have been entirely ruined by these nostrums. When selling this latter material, fairy-like guarantees are made, wonderful stories told about its action; large orders are shown from larger firms, recommendations from many engineers, warranted to remove all scales and deposit if it be lime, magnesia, acids or sulphur. It makes no difference, it is a panacea for all.

People selling the "stuff" will try to persuade you that anything you use outside of their own is worthless, is injurious, and wonder why you use it. They have your interest at heart, (and ready to remove yours if you don't buy). Bribery is resorted to, and, I am very sorry to say, men who call themselves engineers are trapped; they have sold themselves and their reputation, but let it be understood they are few, fortunately. Reputable firms cannot afford to do any business in such away, they sell on the merits of the article. The proprietors of steam plants are the most easily sold." They make purchases of these articles without any consultation with their engineers.

Reputable firms are like doctors; they diagonse the case, analize the water to be used, then prescribe for it. And as it is the engineer who has to clean his boiler, it is he who knows if the articles is doing good. STEPHEN CHRISTIE.

MR. JEFFERSON YOUNG'S PHOTOS.

"I have never seen this Mr. Jefferson Young, whose name is so familiar to readers of THE AMERICAN ENGINEER, of which I have been one for several years," writes one of our subscribers in Missouri; "send me his photograph, for which I enclose postal note for 50 cents."

We have sent it, and have a few more of these cabinets left. We are out of the large photos, however, the 11x14 size, suitable for framing for council chambers, but will have some more made to fill orders received last week.

The price of these large photos is $3.00. And if any councils who have not had them, and think of ordering, will please make up their minds during the coming Supreme Council meeting week, we will get all that are required finished as soon as possible.

THE HARRY HOHN FUND.

Contributions to the Harry Hohn Fund should be forwarded to the treasurer, Franklin R. Moore, 727 Filbert St., Philadelphia, Pa. He reports receipts of the following:—

AMERICAN ENGINEER Pub. Co.	$15.00
Jefferson Young, Jr., S. C. E.	10.00
Eben Hill Council, No. 2, of Conn.	12.00
Kensington Council, No. 3, of Pa.	10.00
Welcome Council, No. 2, of Pa.	5.00
Manayunk Council, No. 9, of Pa.	5.00
Forest City Council, No. 2, of Ohio.	5.00
Geneva Council, No. 13, of N. Y.	7.20
P. H. Bullock, Warnerville, Mass.	5.00
Laclede Council, No. 1, of Missouri.	5.00
Buckeye Council, No. 4, of Ohio.	2.00
St. John Council, No. 1, of Connecticut.	10.00
East St. Louis Council, No. 4, of Illinois.	8.00.
Fort Dearborn Council, No. 1, of Illinois.	10.00
Bay State Council, No. 1, of Mass.	35.00
	$144.20

Treasurer F. R. Moore, whose postal address is given above, says: "We received one check payable to Harry Hohn, and one money order was sent to our corresponding engineer. It would be much better, and will save time, if all checks and money orders, intended for the above fund, be made payable to me; and as soon as I receive the same I send the particulars for publication in THE AMERICAN ENGINEER at once."

A. L. DOUTHETT IN TROUBLE.

A Pittsburgh dispatch of Monday (this week) says: A. L. Douthett, treasurer of the Porter Douthett Company, boiler manufacturers, and ex-superintendent of the Allegheny schools, was arrested to-day on ten charges, the principal one being that of embezzling $7,000 of the firm's money and falsifying the books.

He gave bail to-night, and the hearing was set for Saturday, though the matter will likely be compromised, as he has made over his stock to the firm. Mr. Douthett was the organizer of the American Boiler Manufacturers' Association, for several years its secretary, and a very prominent business man.

ELECTRIC LIGHT IN NEW WAYS.

Nikola Tesla recently demonstrated to the American Institute of Electrical Engineers, at Columbia College, that incandescent lamps may be operated with only one wire, and electric light produced without any lamp. He showed that it is not necessary to provide a "circuit" for the electricity, but that lamps may be located at the end of a wire, and he showed that instead of the delicate and easily destroyed carbon filament now used for incandescent lamps a solid block of carbon that will last for an indefinite time may be employed.

This showing with reference to incandescent lighting sweeps away a large proportion of the expense of the system as it is now operated, and gives ample foundation for expectation that the electric light will soon become the cheapest, as it is the best, light for common use in houses.

If this experimenter had stopped with his substitution of one wire for two, and his block of carbon for the carbon filament, his discovery would have been regarded as one of the most wonderful and useful of all the great electric inventions. But he did not stop there. He went much further, and demonstrated that electric lighting of rooms is possible without the use of any lamp. He showed that a room can be brilliantly lighted by electricity by placing on opposite walls sheets of zinc connected with electric wires and hanging anywhere between these sheets a glass tube from which the air has been exhausted. The plates creates an electrostatic field, and the glass tube will produce the light anywhere within that field.

What the secret of Mr. Tesla's discovery is he did not reveal, but it appears that he transforms a powerful dynamic current of electricity into a static current at the point of utilization, which is something electricians had not previously been able to do. These experiments have attracted the attention of the most expert electricians in this country and Europe, and they anticipate more wonderful results than have yet been announced.

To remove discoloration of the hands brought about by peeling potatoes or other vegetables or fruits, use borax water. Put crude borax into a large bottle and fill with water. When it has dissolved add more to the water, until at last the water can absorb no more and particles are seen at the bottom. To the water in which the hands are to be washed pour from this bottle until the water is rendered very soft. It is cleansing and healthful and will heal scratches and chaps, besides keeping the hands in good condition.

WORLD'S FAIR NOTES.

Thirty acres in the northern portion of Jackson Park have been reserved for sites for the State buildings. The ground has already been apportioned among the States, consideration being had for the size and importance of each and the amount it will probably expend upon its building and collective exhibit. The entire space will be aristically divided by beautiful walks and driveways.

A herd of eighty-five buffalo will be exhibited at the Fair.

An enterprising Nebraska may says that he will take to the Exposition a crowd of 50,000 school children from Omaha and vicinity. He proposes to have each car load in charge of a teacher, and he has already begun negotiations with the railroads for special rates and special trains.

It is next to certain that the Exposition will be open evenings, in all of its departments. The Directory has called for plans and estimates for lighting, by electricity, all of the buildings. It is proposed to light both the buildings and grounds so brilliantly that everything can be seen at night as well as by day, and it is expected that the scene at night will be one of marvelous brilliancy.

At a meeting of representatives of various religious, benevolent and reformatory organizations, held recently in New York for the purpose, a committee of five was chosen to arrange, if possible, for the erection of a separate building at the Exposition, in which can be shown the methods and results of every description of religious missionary and philanthropic work in this country.

The Exposition officials and those of the city of Chicago, have agreed upon police and fire arrangements for the Exposition grounds. Completely equipped police s ation and fire engine house will be erected at once, and the city will furnish them with a full complement of apparatus and men.

An appropriation of $150,000 has been made by the Exposition directory, for the expense of the ceremonies attending the dedication of the buildings, October 12, 1892. The ceremonies will be extended through several days, and some 15,000 militia and U. S. troops, it is expected will participate.

The fine art exhibit, it is now definitely and finally settled. will be at Jackson Park, the strong effort which was made to have it located in the Lake Front Park having been defeated in the Directory. The fine arts building, which will cost about $600,000, will stand in the northern portion of the grounds, and will be nearly surrounded by the buildings of the several states of the Union.

A permanent art palace will be built also in Lake Front park, towards the erection of which the Exhibition will contribute $200,000. During the Exposition this building will be used by the World's Congress Anxiliary for the holding of some of its numerous congresses. After the Fair the Chicago Art Institute will take possession of it and make it the home of a permanent art collection.

One hundred thonsand soldiers gathered from the regular army and national guard would make an effective feature of the World's Fair, so Gen. Miles thinks. The general has suggested such a display in a letter to President Thomas W. Palmer, outlining the distinguished soldier's views on the Exposition.

Gen. Miles would have the World's Fair illustrate the development of the country from the geological era, dividing the displays historically into four periods. The military featuro is suggested in addition to this general historical exhibit, and, Gen. Miles thinks, would be peculiarly appropriate as demonstrating the strength of the nation's citizen soldiery. It would gather together members of the national guard from various States, upbuild a national patriotic spirit, and unite the organizations of different States in a spirit of fraternity. Aside from the good results thus obtained the officers and troops would want to come to the Fair anyway, and most of them would prefer to come to such a mobilization as suggested.

Commissioner Hershfield, of Montana, has asked of Director-General Davis that 200 by 300 feet of space be reserved for Montana. He said that $100,000 would be spent on the building alone, and that the State contemplated constructing a mountain to illustrate placer mining, miners' camps, geysers, waterfalls and other adjuncts of mining regions.

An exhibit from Alaska will be collected under the auspices of the government's Indian bureau and geological department, provided Congress appropriates money for that purpose, as it is expected it will.

As soon as they can be prepared 100,000 copies will be issued of a fine water color lithograph representing a bird's eye view of the Exposition buildings and grounds. The work will appear in sixteen colors. Charles Graham, the artist of *Harper's Weekly*, has made the sketches. These lithographs will appear in public places throughout the world.

Kwong Wo Chiong, a Chinese merchant, in Hong Kong, has applied for space for an exhibit of Chinese goods. Applications for space are getting to be very numerous, and already many have been sent in from foreign countries.

McKeesport, Pa., has decided to make a special exhibit at the Exposition, and is now engaged in raising money for that purpose. The *News*, of that city, inaugurated the movement, and the common council selected a committee to make arrangements. The industries of McKeesport are allied to those of Pittsburg in character.

Lieut. Little, of the Navy department, has sailed for Europe to complete the plans for reducing the caravals which formed the fleet of Columbus. He carries letters of introduction from the State Department to Minister Grubbs and other representatives of the United States abroad. The Spanish Minister has also given him letters to various officials at Madrid. Before going to Spain Lieut. Little will visit the museums at Paris, London and The Hague, as valuable historical material can be obtained in those museums. The Lieutenant has consulted with ship builders in this country and they have advised him that the best way to secure a reproduction of the Santa Maria, the Pinta and the Nina will be to have the most of the work done by the Spanish and Italian ship-builders. The modern American vessel is so vastly different from the fleet of Columbus that shipbuilders have found it difficult to plan a reproduction. They have all agreed, however, that the methods in vogue abroad, where ship carpentry has been handed down from generation to generation, will produce results in keeping with historic accuracy. Caravels will necessarily be given a smaller draught than the original vessels of Columbus, because they are to pass through the Welland Canal, but in other respects the reproduction is likely to be a faithful one.

POISONOUS CIGARETTES.

Dr. Keeley hates a cigarette. This is tho way he talks about them:

"The cigarette habit has become so prevalent in the last twenty years that in all cities they are constantly smoked by everything wearing male clothes from a bootblack to a merchant's clerk. Too much cannot be said of this soul-sapping, body-demoralizing abomination of the present day. The make-up and contents of the cigarette generally found upon the market are that of unripe and imperfectly prepared tobacco. This tobacco is first soaked in nicotine, largely impregnated with opium, stramanium, or belladonna. The wrapper is usually rice paper whitened with arsenic. It will readily be seen, therefore, that the main evil of cigarette smoking arises from the inhalation of carbon-monoxide, which is extremely poisonous on account of its strong affinity for the hæmoglobin of the blood, which brings about cardiac inhibition and heart-failure. Every day the papers are filled with some story of death by heart-failure from the excessive use of cigarettes; and sixteen States, by Legislative action, have prohibited their use among boys for this reason. It is the duty of every family physician to explain to those over whose health he has supervision the evil consequences of the use of cigarettes, and it ought to be the duty of the secular and religious press to denounce their use at every opportunity, as in every case they bring about a necessary desire for either opium or alcoholic drinks."

"WAIT IN THE HALL."

In London it is not considered "good form" for a gentleman to carry through the streets a parcel, however small or elegantly wrapped. He may carry a book, if it is not too large and is not wrapped up; for a book is a book, but a parcel may be a pound of cheese or a dozen red herring. The restriction is a foolish one; a form of class distinction that is inconsistent with the highest civilization, in which every man will be a gentleman if he is thoroughly considerate of others, whether he is a laborer or rides in a carriage. The author of "England, Without and Within" gives an anecdote of an easy-going English gentleman, who was not bound by the absurd law against parcel-carrying.

A shoemaker had missent to him a pair of shoes intended for a neighbor, and had probably sent to the neighbor the shoes that should have been sent to him. As he had no prejudice against carrying bundles, he went with the shoes to his friend's house.

On arriving at his friend's door he asked to see Mr. Dash, but was understood by the servant to ask for Mrs. Dash, and was ushered into her presence. The lady, who had never seen him before, looked up and curtly asked:

"What have you there?"

"Mr. Dash's shoes," replied the gentleman.

"Oh, yes; it's all right. Mr. Dash is out, but he'll be in soon, and if you want to see him you'd better take a seat in the hall, and wait until he comes."

"But, madam—" began the gentleman, who was a baronet's son.

"Never mind, never mind; it's all right. Step out in the hall, please, and wait for Mr. Dash."

The gentleman, of course, appreciated the situation at once. But he was to well-bred and had too keen a sense of humor to explain, which would have both mortified the lady and prevented him from enjoying her mistake. He stepped into the hall, intending to give the shoes to a servant and leave the house.

But meeting his friend coming in, he gave him the shoes and, after a few words, bade him good morning. Though pressed to remain, he refused, knowing that his return to the wife's presence would cause her embarassment.

His consideration for the feelings of another person would have made him a gentleman if he had been a hod-carrier.—*Youth's Companion*.

AN ELECTRIC FLYING MAN.

The failure of the numerous inventors who have endeavoured to solve the problem of aerial navigation, or rather flying in the air does not appear to deter others from trying to find the solution. M. Ader, of French telephone fame, is the latest addition. He is reported to have invented a flying machine in which electricity forms the motive power, and is said to have just made a successful ascent in the park of a Paris financier. He is said to have travelled at a height of 66 feet, a distance of from 300 to 400 yards, and to have ascended, descended and navigated himself according to his own sweet will. Of course all details of the apparatus, which is not a balloon, are rigorously kept secret and will not be made known until the inventor has made "an irrefutable demonstration in the presence of delegates of the Academie des Sciences." Most people will look forward with—well, doubts as to the "irrefutable demonstration" of the flying man —*Electrical Review*, London.

ATTRACTION OF PILE DRIVING.

What is there in a pile-driver, or its operation, that stimulates human curiosity to such a noticeable degree? The putting up and setting in operation of a pile-driver anywhere is sure to immediately draw a crowd, and keep a considerable portion of the people who compose it standing idly by to watch the monotonous repetition of the movement of the pile-driver's simple machinery and heavy weight, which is drawn up and then let go, to come down with a thud on the top of the unoffending and helpless stick of timber, driving it every time a few inches deeper into the mud. Wherever this operation is going on, you will see a crowd of from a dozen to one hundred and fifty men and boys, who appear to take as much interest in it as they would in a Punch and Judy show or a dog fight. We do not understand where the curiosity-exciting element is. After one has seen the big thumper go up and come down once, he has seen all he ever will see of the mystery of pile-driving. Yet crowds of idlers are found hanging around the pile driver's station for hours. Are these people really curious, or are they only lazy and loafing?—*The Evening Journal* (Jersey City).

HOW MUCH DO YOU KNOW?

"General ignorance questions," as they are called, being now in favor with those who are intrusted with the duty of educating our boys, says the London *News*, the private schoolmaster has taken the trouble to suggest a string of appropriate tests of knowledge of familiar things. The chief of these are: "Why does an apple fall to the ground?" What is a jury and how are jurors elected?" "Explain as you can the action of the electric telegraph." What keeps the earth in position?" "How would you spend a present of £5 in books?" "Why do most leaves turn color in autumn?" "What is the difference between tradition and history, art and science, parable and allegory, murder and homicide, simulation and dissimulation, bill and act?" "Name some of the chief English daily and weekly newspapers." "Name some of the planets that move round the sun." "Why does marble appear colder to the touch than wood?" "How many senses have we?" The author of this little plot does not conceal the fact that he looks forward to electing some "amusingly original answers." Big boys, he thinks might also be tried with those old-established "posers:" "What would happen if any irresistable body came into contact with an immovable post?" and "How is it that big rivers always 'make for' and flow through large towns?" The ludicious schoolmaster will probably deem it fair to postpone these diversions till the holidays are over.

HE WAS "PORTER."

Etiquette is after all so intangible a thing that it is necessary to learn it anew for each situation in which one is placed, and there are often instances where there is a strong temptation to laugh at the whole scheme of social distinctions.

Not long since a gentleman who has traveled much, and has acquired the habit —which certainly is a questionable one—of calling every waiter John, chanced to be in a parlor-car between New York and Boston, and to wish to ask some service of the porter.

"Look here, John!" he began, "I wish——"

But the porter interrupted him with the utmost gravity of manner.

"On this car, sir," he said, "it is etiquette to call me 'porter,' and that I will answer to. You have not an acquaintance with me that warrants you calling me by my Christian name, although," he added, seeing that the stranger was staring at him in undisguised amazement, "if you really want to know my name I will give you my card."

The passenger muttered something incoherent and then went meekly away to sit down and try to recover his moral balance.

The detailed uses to which ordinary limestone is put are numerous, and some of them are of vast importance, because they can not be fulfilled by any other kind of stone. Some of the uses to which limestone is put bring it into competition with the granites and sandstone, such as building of all kinds, road making, and structural purposes generally. In many of these cases limestone is inferior to other kinds of stone, and is selected on account of accessibility or cheapness. In its application to lime burning and blast-furnace flux, however, limestone stands alone, and large quantities are devoted to these purposes.

LITERARY.

Heating for Health is the title of a neat little book, neatly bound and curiously covered, issued by the Westminster Publishing Co., New York. The author, Frederic Tudor, an eminent architect of Boston, explains how best to heat a house in a manner most conducive to health, that is by hot water, which he describes as a novel system, but not new. Heating by hot water is the most ancient mode, while it is the most economical as well as the healthiest, especially when accompanied with proper ventilation. The hot water system has been "in abeyance while the furnace and steam heater have ravaged the land;" but lately "the world has waked up to the fact that it is not so much cheap things that it wants as things that are good." Mr. Tudor's pamphlet will convert many.

CHICAGO, MILWAUKEE & ST. PAUL RAILWAY.

Electric Lighted and Steam Heated Vestibuled Trains, with Westinghouse Air Signals, between Chicago, St. Paul and Minneapolis, daily.

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MAP OF THE UNITED STATES.

A large, handsome map of the United States, mounted and suitable for office or home use, is issued by the Burlington route. Copies will be mailed to any address on receipt of 12 cents in postage by P. S. EUSTIS, Gen'l Pass. Agent, C., B. & Q. R. R., Chicago, Ill.

FOR SALE CHEAP.

ONE AUTOMATIC CUT-OFF ENGINE, 16 x 36.
Can be seen running at 222 to 230 W. Ohio St. Chicago.

CONTRACTS OPEN.

Water-Works.—The Village of Madelia, Watonwan County, Minn., will let contract to the lowest responsible bidder July 29, 1891, at one o'clock p. m., for high tank and water mains. Right reserved to reject any and all bids. $9,000 to be expended according to the plans and specifications on file in Recorder's Office. C. COOLEY, Recorder, Madelia, Minn.
Dated June 27, 1891.

Water Works Extension, Section "H," Low Service Conduit. Sealed proposals for the public work hereinafter mentioned will be received at the office of the Board of Public Improvements, St. Louis, Mo., until 12 m. of the 21st day of July, 1891, at which hour they will be publicly opened and read, viz:

Letting No. 3,456. For making the required excavation and embankment and building section H of the Low Service Conduit complete in working order.

The following are the approximate quantities of the work to be done, viz:

a 13,000 cubic yards excavation.
b 1,500 cubic yards borrowed earth.
c 3,700 cubic yards concrete.
d 2,200 cubic yards brick masonry.
e 18,500 square feet granitold.
f 100 lineal feet 36-inch cast iron pipe culvert.

Deposit required, $1,319.

Proposals must be made on blank forms furnished by the Board of Public Improvements.

The right to reject any and all proposals is expressly reserved.

Plans may be seen and specifications and forms of contract may be obtained upon application at the office of the Water Commissioner, room 27, City Hall.

By order of the Board, GEO. BURNET, President. Attest: Emory S. Foster, Secretary.

Viaduct.—Proposals for constructing a viaduct.—Rock Island Arsenal, Rock Island, Ill., June 23, 1891.—Sealed proposals, in triplicate, will be received until 2 o'clock p. m. on Saturday, July 25, 1891, for furnishing, constructing and erecting the iron and all other work complete, except masonry, excavations and fill, for a viaduct from south end of the Rock Island Wagon Bridge, between Rock Island and the city of Rock Island, over the railroad tracks which adjoin the approach to the said bridge, including the raising the said bridge to an inclination required to form a continuous roadway with the viaduct. Plans and specifications, with full instructions, stipulations, etc., and the blank forms on which proposals must be made, can be had on application to Captain M. W. LYON, Ord. Dept. U. S. Army, Commanding.

Water Pipes Etc.—Sealed proposals for the public work hereinafter mentioned will be received at the office of the Board of Public Improvements, St. Louis, Mo., until 12 m of the 21st day of July, 1891, at which hour they will be publicly opened and read, viz: Water Pipes. Letting No. 3,447. For furnishing and delivering at the City Pipe Yard, about 640 tons of six-inch and 12-inch cast iron coated water pipes. Deposit required, $523.

Special castings. Letting No. 3,448. For furnishing and delivering at the City Pipe Yard, about 15 tons of cast iron coated special castings. Deposits required, $75.

Stop Valves. Letting No. 3,449, For furnishing and delivering at the City Pipe Yard, about 19 six-inch, 12-inch and 15-inch stop valves. Deposit required, $90.

Laying Water Pipes. Letting No. 3,450. For making excavations and hauling and laying complete, in accordance with specifications, about 11,500 linear feet of 12-inch water pipe.

100 linear feet of six-inch water pipe.

Setting complete, eight fire plugs.

Furnishing 300 pounds of wrought iron straps, bands and bolts. Deposit required $238.

A separate proposal must be made for each letting on a blank form furnished by the Board of Public Improvements.

The right to reject any and all proposals is expressly reserved.

Specifications and forms of contract may be obtained and drawings may be seen upon application at the office of the Water Commissioner, room 27, City Hall.

By order of the Board. GEO. BURNET, President. Attest: Emory S. Foster, Secretary.

Pumping Engines.—Sealed proposals will be received by the City of Savannah, Georgia, until eleven (11) o'clock a. m., July 15, 1891, for furnishing and constructing two (2) High Duty Pumping Engines, each having a capacity of ten million (10,000,000) U. S. gallons per day, and the necessary boilers and other appurtenances pertaining to a pumping plant. All to be in accordance with general specifications on file in the water office, at Savannah, Ga., or which, with all other information, can be obtained from Thomas T. Johnson, Consulting Engineer, at room No. 29, No. 171, La Salle street, Chicago, Ill. Proposals must be made in accordance with the aforesaid general specifications. No proposals will be considered unless the party offering it can furnish evidence satisfactory to the Mayor and Board of Aldermen of the City of Savannah of his ability, and that he has the necessary facilities, together with pecuniary resources, to fulfill the conditions of the contract and the specifications, provided such contract should be awarded him. The right to reject any and all proposals, not deemed for the best interest of the city, is reserved. JAMES MANNING, Superintendent, Office Water-Works, Savannah, Ga., May 21, 1891.

Dredging.—United States Engineer Office, No. 366 Milwaukee street, Milwaukee, June 19, 1891.—Sealed proposals in triplicate, will be received at this office until 12 o'clock, noon, July 15, 1891, and then opened in the presence of bidders, for dredging at Milwaukee Harbor, Wis. Approximate amount of dredging to be done, 26,000 cubic yards. The attention of bidders is invited to the acts of Congress, approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. Proposals will be accompanied by a guarantee that if the bid is accepted, contract will be entered into within ten days after notice of acceptance. Preference will be given to material and plant of domestic production or manufacture, conditions of quality and price (import duties included) being equal. For blank proposals and information apply at this office. The United States reserves the right to reject any or all bids. Proposals will be endorsed on the envelope, "Proposals for Dredging at Milwaukee Harbor, Wis.," and addressed to Major CHAS. E. L. B. DAVIS, Corps of Engineers, U. S. A.

Pumping Engines.—Sealed proposals will be received by the City of Savannah, Georgia, until eleven (11) o'clock, a. m., July 15th, 1891, for furnishing and constructing Two (2) High-Duty Pumping Engines, each having a capacity of Ten Million (10,000,000) U. S. gallons per day, and the necessary Boilers and other appurtenances pertaining to a pumping plant. All to be in accordance with general specifications on file in the Water Office at Savannah, Ga., or which, with all other information, can be obtained from Thomas T. Johnston, Consulting Engineer, at room No. 29, No. 171 La Salle street, Chicago, Illinois.

Proposals must be made in accordance with the aforesaid general specifications. No proposal will be considered unless the party offering it can furnish evidence satisfactory to the Mayor and Board of Aldermen of the City of Savannah of his ability, and that he has the necessary facilities, together with sufficient pecuniary resources, to fulfill the conditions of the contract and the specifications, provided such contract should be awarded him.

The right to reject any and all proposals not deemed for the best interest of the city is reserved.

JAMES MANNING, Superintendent.
Savannah, Ga., May 21, 1891.

JULY 18, 1891. The American Engineer. VOL. 22, NO. 3.

ZELL SAFETY WATER TUBE BOILER.

The water tube boiler shown in the larger engravings on this page is similar in appearance to other boilers of this class. But it has special features, which increase its efficiency, safety and economy, it is claimed. It is the invention of Robert R. Zell, of the Campbell & Zell Company, Baltimore, Md. Mr. Zell is the vice-president and general manager of the company.

This boiler, as may be partly seen from the cuts, consists of a series of four-inch lap-welded tubes, which are expanded at their ends into headers or end boxes, forming sections placed in an inclined position. The sections or water legs contain four tubes; these are placed one above another, and are connected by a short piece of four-inch boiler tube, expanded in a hole in the top and bottom of each header, forming a continnous steam and water passage. The caps or plates are placed inside, forming a perfect joint, which is milled off by a special tool.

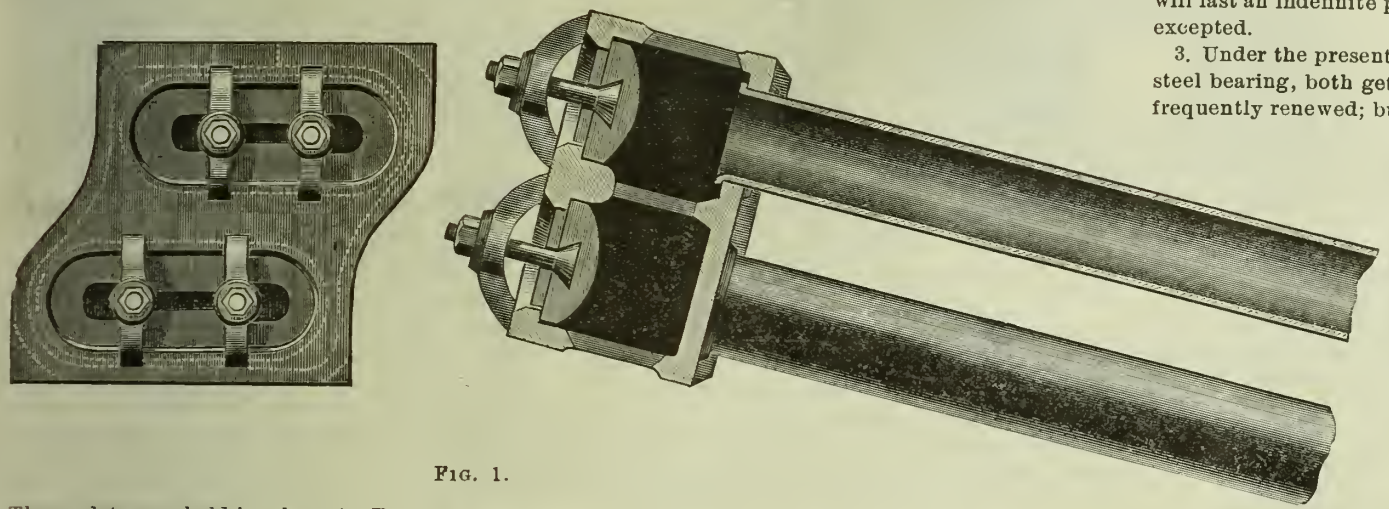


Fig. 1.

These plates are held in place by T-headed bolts that fit into pockets on the face of the plates. The sections are placed in vertical rows and connected together by expanded nipples, the top row only being connected at their sides. From the top row of the sections, a short piecc of tube is used to connect the two water drums, which lay at the same inclination as the water tnbes; upon and across the front end of these drums a row of headers is placed and connected together, into which a series of tubes are expanded at one end, the other end being expanded into the sides of a steam drum, which is placed in a horizontal position across and above the rear end of the water drums, to which it is connected by two four-inch tubes encased in cast iron. All joints and connections are expanded.

The rear end of the boilers rests on two cast iron saddles placed nnder the mud drum, while the front end rests upon a roller placed upon the top of the arch box, which is bolted to a cast iron bracket and secured to the fonndations. The fronts, which are of special design, have cast iron trimmings. The doors are self-ventilated, of light weight, and have liners of such shape and arrangement that they will not burn ont.

When this boiler is in operation the heat from the fire in the furnace passes up between the staggered tnbes, then down and aronnd the tnbes between the flame bridges to the bottom of the combustion chamber, thence up again, when it passes out to the chimney through the space between the steam and watcr drums, making three runs across the water tubes. The feed water enters the water drums at their rear ends in sufficient quantity to maintain the level at a point below the bottom of the steam drnm.

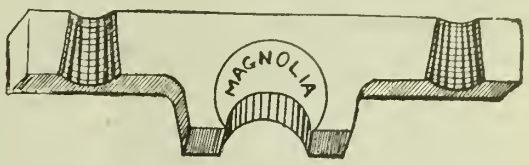
The water in the inclined tubes next to the furnace is heated and raised to a rapid state of ebullition, the mingled body of steam and water, being lighter than the solid water in the rear of the water drum, is forced rapidly up through the front headers into the water drums, where the steam and water separate, the water returning back through the water drums, while the steam passes up to the top front headers and superheating tubes, where, being surrounded with the radiating heat and gases, additional heat is absorbed, evaporating any entrained water in its passage through the steam tubes. Thus the steam is delivered dry into the steam drum, which being jacketed by the waste gases in their passage to the chimney, and having a temperature a few degrees higher than the steam within the drum, more heat is absorbed by the steam, and it becomes further superheated. This special feature of construction is covered by the Zell patents. Further information may be obtained from the company's works, at Baltimore, Md., or W. A. Ross, manager of their Chicago office.

NEW APPLICATION OF MAGNOLIA METAL.

The small cut in this column is that of a Magnolia-lined bearing pedestal. It shows an ordinary metal cod, which is lined with Magnolia antifriction metal properly fitted in, for pit tnb and wagon bearings in collieries.

Among the special advantages claimed for the Magnolia lining are the following:

1. The superior anti-friction properties of the bearing ensures great economy in lubrication.



2. When these bearings are worn down, the Magnolia metal can be renewed by any mechanic at the colliery, and the iron or steel body of the bearing will last an indefinite period; breakages, of course, excepted.

3. Under the present system of steel axle, against steel bearing, both get worn out, and have to be frequently renewed; but with these Magnolia-lined bearings the axle receiving an enamelled surface from the Magnolia metal, does not show any appreciable wear, and will probably out-last the tub itself.

4. It is found on extended trial that the lessened friction with these Magnolia-lined bearings enables a greater number of tubs to be hauled by a given engine power.

These Magnolia-lined bearings can be obtained in any particular size and shape that may be required.

For further information address the Magnolia Antifriction Metal Co., Cortlandt St., New York. Mining engineers are specially invited to communicate with them.

To freshen up faded green blinds rub on them a little linseed oil.

Those who use green wood for fuel understand how wasteful is the moisture of the heat obtained. Wet coal is just as objectionable except for the fact that the heat it gives in burning is so much that the waste is not noticed. The wood-shed or coal-bin should therefore be not only well covered but protected so that it may not be wetted with rain in summer or snow in winter.

For seven years a mechanic made a circuit of half a mile twice per day rather than pass a powder magazine. The other day he learned that it had been empty for eight years.

THE ATLAS SELF-CONTAINED ENGINE.

The engravings on this, and part of those on the next page show the self-contained engine, and its parts, recently placed on the market by the Atlas Engine Works, of Indianapolis, Ind. It was designed with the view of meeting a strongly-felt want for a solid self-contained engine, in preference to side-crank engines requiring an out-board pillow block. This self-contained engine is more substantial, and more suitable for continuous service, such as is required at electric central stations than those previous made at the Atlas works. And when placed on a solid foundation these new Atlas engines, it is claimed, will work remarkably well. They are built in two types; namely, the automatic cut-off engine, shown in perspective on this page, and the throttling engine, a cut of which we hope to publish in our next issue. Detail cuts of the two types, some of which are common to both, are shown herewith.

The crank shaft illustration at top of opposite page shows how the metal is disposed in the frame, at and near the main bearings. The body of the crank pin is of iron, which is considered more reliable than steel for resisting shocks and strains. A steel collar is welded around the iron, at the center of the pin, because steel affords a better wearing surface than iron. This composite counter-balanced crank shaft is common to both types of engines. So is the connection rod, which is of the locomotive type, with the strap in three parts, as shown in the upper cut on this page. The top and bottom pieces are counterbored, and the projections on the end piece are fitted thereinto. The end bolt is thus relieved from shearing stress, and its only duty is to hold the parts of the strap together.

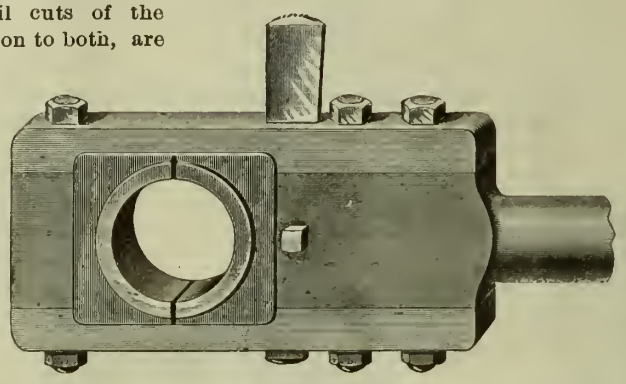
The valve (Fig. 3), for the automatic engine, is a balanced slide, its two ends being of equal area, and it is relieved from pressure against the seat. When working, it is covered by a hood with false ports corresponding to the valve face ports, the two kinds of ports being in direct communication, and thereby the pressure is equalized on both sides of the valve. And the false ports furthermore provide a larger and more rapid port opening for a given valve travel. As will be seen in the cut, the valve is held in position by four top bolts, one at each corner. The hood is not held down tight by these bolts; they merely hold it in position, but not firm to its seat against the cylinder. That is to say, the hood is free to lift a short distance on these bolts, being resisted only by the springs shown in Figs. 1 and 2. Hence, in the case of water in the cylinder, the valve, carrying with it the hood, can readily leave the seat, the springs again returning it, the bolts guiding the hood.

This valve may readily be refitted, by ordinary machine processes, should it become worn.

In the governor for the automatic engine, shown in cut between Figs. 2 and 3, long springs are employed, and the leverage is such as to give great power, while the construction is such as to secure the necessary sensitiveness. This is considered much better than the fly-ball governor.

The parts of these engines are "manufactured" to die and templet, and are consequently interchangeable. They are made for cylinders 7 inches diameter and upward, each size increasing one inch. They are said to be capable of a piston speed of from 600 to 700 feet per minute.

The Atlas Engine Works, by these improvements, show their determination to keep right in the front of the steam engine business, and be second to none.



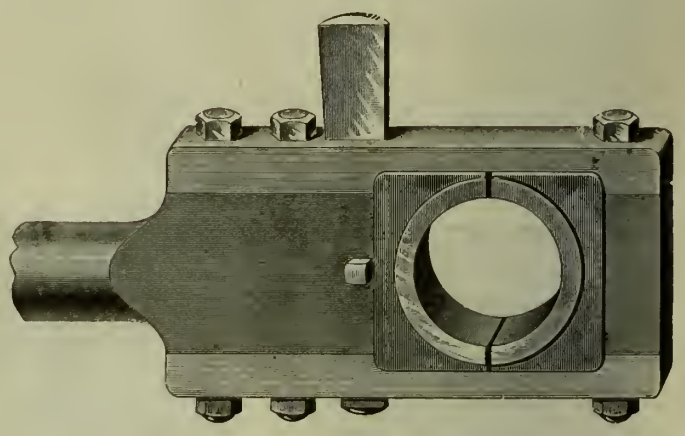
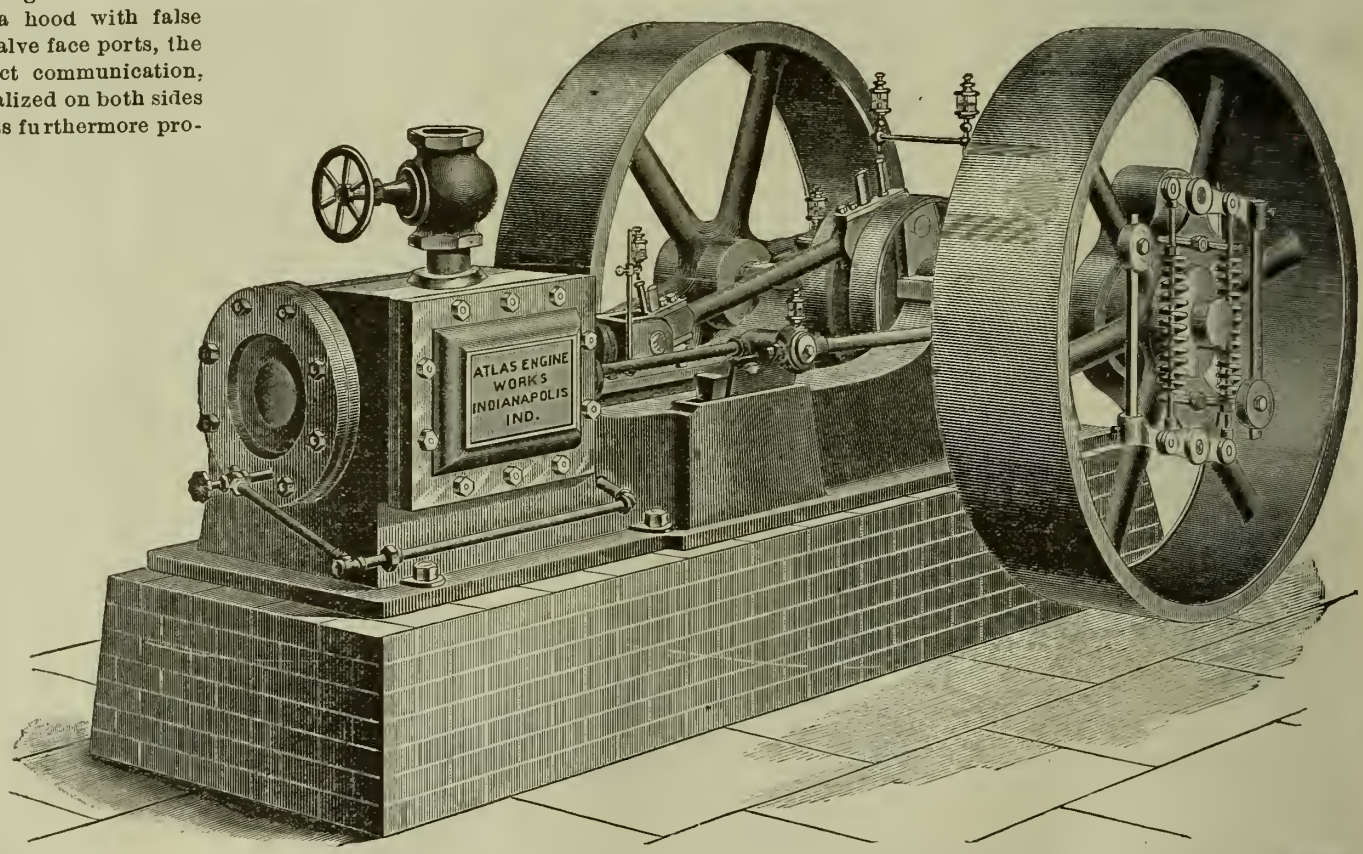


FIG. 1



THE COMING MECHANIC.*

BY CHARLES F. PERRY, CUSHING ACADEMY, '91.

By the words, "The Coming Mechanic," is meant the energetic, intelligent workman of the near future. Sad though it may be, true it is, there are many artisans who can never be classed under this head. These are the ones who in every community and every branch of industry have no higher ambition than to be simply the machinery of the thinking man. Such persons though they may have a mechanical turn of mind, though they may become journeymen workers, cannot appropriately receive this name.

Reviewing for a moment the accomplishments of the mechanic of the past, we find they have left some problems which are still unsolved. Such old time questions as how the pyramids were built and those vast Roman acqueducts were constructed. But such achievements fall into insignificance when we place beside them the Atlantic cable, the Suez canal, and the Eiffel tower.

*Graduation Oration.

We find the growth of mechanics a very gradual one when we consider the age the world had attained before the power of steam was discovered and used to advantage. The steps were first hand power and animal force, then the use of light, wind, gravitation, the lever, pulley, incline plane, wheel and axle, wedge and screw, until the time of Watt in 1769 when the true value of steam was found.

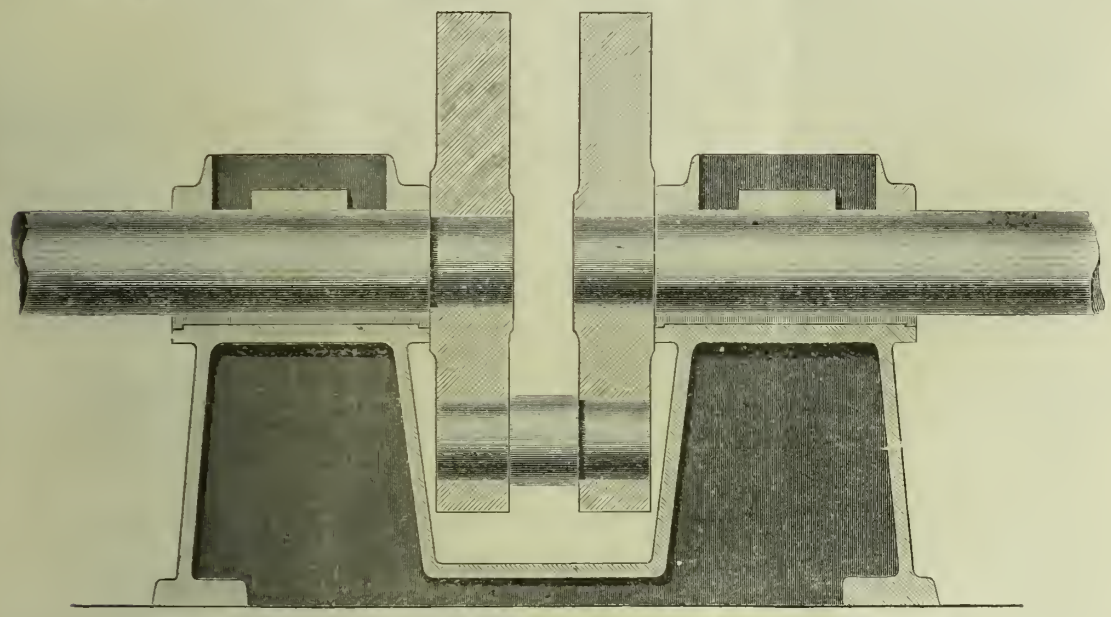
From the time when artisans first learned to use the forces of nature until 1769 we will call that period the age of the mechanic of the past. From 1769 to 1891 the period of the mechanic of the present, from 1891 to the time when mechanical ingenuity will cease to be needed, the age of "The Coming Mechanic."

Comparing the present mechanic with the ones of the past we find there has been great improvement. The workmen of to-day are more intelligent, more energetic, and more industrious than their forefathers. It is said, and with good reason, that the inventions of the past fifty years have far exceeded those of all previous time. The strides in mechanical development have been enormous, so much so, that the supply of intelligent mechanics is far below the demand. The more civilized a people become, the more numerous are their needs, and these must be supplied. There is a demand for the cheapest and most practical machinery. The great competition in all industries at the present time requires capable men.

Statistics which show a large ratio of gain in the annual increase of mechanical and industrial publications prove that the present mechanic is fast becoming a more intelligent man. The vast amount of useful information and practical helps he can thus obtain is not to be neglected. National expositions is another source which arouses the mechanic's desire for a broader education and gives him the incentive to obtain one.

Notwithstanding all this progress, and the intelli-

gences of the present mechanic, he is not what he should be. His education is too narrow. He is too much a part of the machine he is running. The material upon which he is to labor is brought to him and with it a model drawing, or instructions of some kind telling him how the work is to be done. He simply follows these directions until his day's task is ended and thus he spends his life. He cannot explain the whys or wherefores of the work in hand. The fact is, he has not been taught to think. The immediate present and the near future call for



men who can think and put their thoughts into practical shape. Educated and practical minds seeing the urgent demand for such capable workmen have tried to satisfy it by founding schools in which the youth of to-day may be educated to be intelligent mechanics. The advantages of such institutions cannot be too fully valued. Mechanical genius has been too much a monopoly, it is now to be more equally divided.

The two boys start out in life, one to learn a trade and the other to study in a scientific school. They each spend four years at their respective duties. At the end of that time let us compare their relative standing in the eyes of a critical world. The one who has worked in the shop has adept fingers, that is all of real importance. Look at the graduate. Not only has he adept fingers but a disciplined mind. He is the better workman in every sense, for in his practical instruction he has been taught to use tools to the best advantage while the apprentice has acquired his experience by observation only. Very rarely does the foreman take the pains to show him how to do his work, and when the young man is at a loss how to proceed, he seeks help from some of the workmen who frequently do not instruct him in the best possible way of doing it. Perhaps the apprentice would have taken the educational course, but the assurance of weekly wages from the beginning of his apprenticeship allured him to choose the path he did. But he sees his mistake when the graduate at the end of his four years secures a position which from the start pays a larger salary than the other will ever receive. Thus we see the journeyman apprentice far outstripped by the practical graduate.

Many workmen to-day seeing their error and who can ill afford to educate their boys, are denying themselves of many necessities in order that their sons sons may profit by the mistakes they themselves have made. There should be more scientific schools and their tuition cheaper in order that those who are too poor to attend may have the same advantages as the sons of the wealthy. Every school in fact, should have an industrial department not with the intention of making every boy a mechanic, but with the aim of instilling into each youthful mind enough principles of mechanics to train him to use tools to advantage. Many men are to-day working at some trade or profession for which they are not adapted for the simple reason that in their youth they had not the privilege of following their particular bent. An educated man can drive a tack with more skill than an uneducated one. It is obvious, "The Coming Mechanic" is to be far superior to the present one, He is to be educated in a mechanical atmosphere and will be not only theoretical but practical.

The picture of "The Coming Mechanic" has not been overdrawn. The president of one of the leading Polytechnic Institutes of this state, since the last class graduated, has received applications for more than twice its number. A person has but to read the catalogues of these schools to find the proof of these facts. There will be found the name of the alumni and the positions they are at present filling.

The success of a nation depends upon the intelligence and morality of its citizens, and money placed in an education is the best paying investment of to-day.

Watt and Stephenson were the successful mechanics of the past, Ericsson and Edison the more successful ones of the present, but the greatest success in industrial science is yet to be won by "The Coming Mechanic."

THE FISHER PUMP REGULATOR.

The accompanying cuts of the Fisher pump regulator, or pressure governor, in the upper part of this column, show the features of this most useful device. It is to be obtained from the Fisher Governor Co., of Marshalltown, Iowa. And it is made to operate in two ways. One style is designed to stop the pump after the water gets to a certain heighth in the tank; the other is operated by water pressure. The cuts seen here show the latter device. The regulating apparatus is shown in the middle, and the valve in the steam pipe may be seen in the sectional cut, as well as the spring (in the upper part) which works the regulator. It is hardly necessary to say that it works automatically. As soon as enough water has been pumped, the pump takes a rest; and when more water is wanted the pump starts of itself; that is, the spring rises as the water diminishes in the tank, and as the spring rises the steam valve opens and the pump operates forthwith.

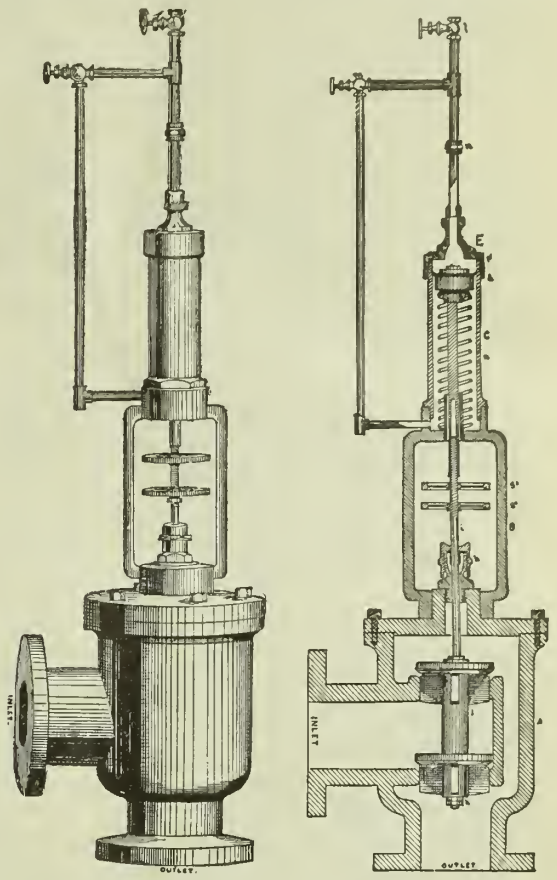
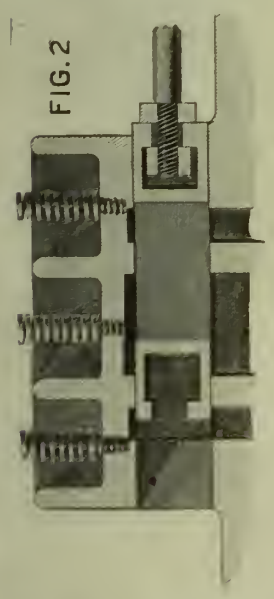


FIG. 2



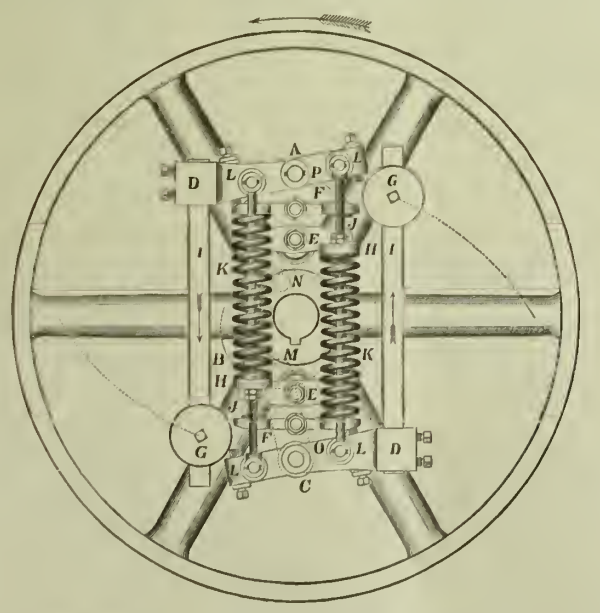
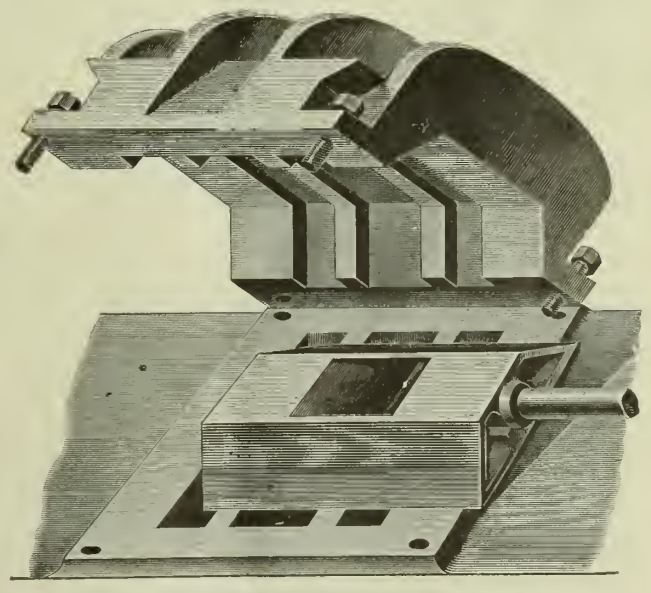


FIG. 3



This regulator is in use in government and other public buildings, and it is finding its way rapidly in all plants wherever steam pumps are at work. We are well acquainted with one which has been in operation in the Calumet Building, Chicago, two or three years; and we know, from personal observation, that it works most admirably. The engineer of the building says he never has occasion to concern himself about the water in the tank.

Further information may be obtained from the manufacturers, whose address is given above.

The American Engineer.

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JEFFERSON YOUNG, JR., - - Associate Editor.

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TO WHOM IT MAY CONCER.

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JEFFERSON YOUNG, JR.
Supreme Chief Engineer A. O. of S. E.

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SAFETY to life and property is one of the leading principles of law and civilization. In Old Testament times the governing principle of social life was "an eye for an eye, a tooth for a tooth," etc. And whoever shed man's blood, had his blood shed by man—unless the killing was done accidentally or without malice aforethought. In these latter days, however, there is a strong feeling against capital punishment, and, many men (to say nothing of women) feel that it is wrong to send a human being out of this life, by process of law, even though that process be by the smooth, expeditious and painless path of the electric current. But our law stipulates that whoever kills shall be put to death. And although we still excuse a man from death if he kills any one without premeditation (if such can be proved to be the case), yet he does not go unpunished, unless he happens to be favored by Judge Hook or Judge Crook. And, as a rule, punishment follows the killing of any one—if the one that is the cause of the killing is to blame in the matter. Prof. John E. Sweet's eloquent paper read at the A. O. S. E. Convention this week (which we publish in full in another part of this issue) shows that men whose ignorance or carelessness permit boilers to explode, and thus killing people, are not punished enough. The Professor's aim is not to advocate more punishment, however, but to make prevention more sure, by refusing to let incompetent engineers to have charge of a steam engine. A good license law would go a long way towards securing far greater safety.

THE SYRACUSE CONVENTION.

In another part of this issue (pages 26, 27 and 28) we publish a report of the opening end of the sixth annual meeting of the Supreme Council of the American Order of Steam Engineers at Syracuse, N. Y. The public meeting in the great Alhambra hall was evidently a loud one, if we may express it in that way; that is, it was well attended, the audience was thoroughly appreciative, the mayor of the city together with the lieutenant governor of New York State were there, and in good humor; and finally the oration of Chief Young, the admirable paper read by Prof. Sweet, Bro. Jacks' advocacy of the widows and orphans fund, and the addresses of the Mayor and the Lieutenant Governor, all made such an abiding impression that the event will never be forgotten by those who were so fortunate as to be present.

The exhibition of steam machinery and appliances added much to the interest of the occasion. Altogether, the American Order has had such a convention this time, and the proceedings have been so extensively reported, that there can be no misgiving henceforth, in any section of this vast country, as to the principles of the Order.

It was built up, five years ago last April, as Chief Young somewhat figuratively said, like a castle in the air. But it is evidently here with staying qualities.

In the short period of five years the small one has become—not only a thousand but five times the Scriptural figure. And if the growth of the A. O. S. E. will be at a similar rate the next five years as it has been in the past, it will be a most powerful organization in 1896. Let us see, they started with four men; four multiplied by 1,250 equals 5,000. Now if the present 5,000 be increased by the same multiplier (1,250) it will reach 6,250,000. Of course it cannot reach anything like that figure simply because there are not so many steam engineers in the whole world. And the American Order is "an order of engineers, for engineers, and engineers only." In this fact much of the strength of the Order lies.

When the newspaper men saw Lieutenant Governor Jones, and other prominent men, taking part in the public proceedings of the convention they imagined, at first, that it was a political meeting, in disguise, but they were soon convinced of their mistake. "No mulee, no horsee, no pullee; but going like hellee" was the exclamation attributed to the Chinaman when he first saw a cable car running. "No Republican, no Democrat, no Prohibition—no politics at all" can be found in the American Order of Steam Engineers, and yet their sixth convention has evidently been a great success, and as popular as many a political convention. The Order is held together by the bonds of Love and Sympathy, and increasing rapidly by the heat of fraternal affection.

We hope to have the remainder of the report of the Syracuse Convention in our next issue.

"PERFECT COMBUSTION OF SMOKE" AGAIN.

The following appeared in the Chicago *Tribune* of Sunday last:

"The public are invited to inspect the Wood & Westbury system of perfect combustion of smoke in steam boilers. They have invented a new field, inasmuch as all efforts heretofore to consume smoke have been directed to the effects of combustion over the furnace. Complicated systems of steam jets have been directed over the fire. The results have been a clincared fire and burnt boiler. Not so with our system. We place ourselves at the head with our system of perfect combustion, and we now stand ready to fill the long-felt want of the people by doing away with all smoky chimneys. In our system the combustion of gases is effected in a combustion chamber in connection with proper air ducts, whereby the smoke is consumed without a wasteful use of steam and an economy over all others as to removal; in fact, will last as long as the brickwork of boiler lasts. Skeptical people can investigate and be convinced by visiting the Leland Hotel, where the appliance is working, and all information will be cheerfully imparted by

"C. A. WOOD, Engineer; D. A. WESTBURY, Steam Engineer."

Recently we published a discription of the Walker Smoke Consumer, which is used in the Boston *Globe* building, and has been praised "to the skies" by that paper. It was not convenient for us to call and see it for ourselves. But the Leland Hotel, at Chicago, is within a short distance of our sanctum. So, on Monday morning we went, with joyful steps, and in response to the invitation in their "ad," to see Messrs. Wood and Westbury's "system of perfect combustion of smoke in steam boilers" in operation. The engine room, at the Leland, is well ventilated, after one finds it. Engineer Wood is a man of ripe years and good engineering experience. No other could hold the position. He was able to show us—the smoke. The tall chimney was emitting the ascending refuse of the fuel in volumes that were easily seen. Mr. Wood apologized for the shortcoming of the "perfect" smoke consumer by stating that the fuel used just then was unusually smoky. We thought that afforded the best opportunity to demonstrate the perfection of the Wood-Westbury system. For the most much-felt want of the day is a scheme to "consume" or destroy the thickest smoke.

Such a device we have not yet seen.

THE N. A. S. E. STILL ON DECK.

Like the proverbial cat with nine lives, Mr. W. B. Austin sticks to his official life as Chairman of the Committee of Arrangements for the convention at Omaha, Neb., and declares, by resolution of the said Committee, that "Omaha No. 1, N. A. S. E., has made all necessary arrangements, pecuniary and otherwise," for the entertainment of the delegates next September. At all events, that is the pith of a resolution, with three whereases, which they "respectfully request" THE AMERICAN ENGINEER to publish. But we regret, with all due respect, to have to say that their third preamble and the resolution are based on a foundation of sand, inasmuch as they assert "that certain parties, evidently enemies of the N. A. S. E. and the City of Omaha, have, in underhanded ways, sought to convey the impression that the Omaha convention would be a failure through our inability to fulfill our pledges."

What made the outloo somewhat discouraging for the coming "Omaha convention" was the organization of the David Gilbert Council, of the American Order of Steam Engineers, at Omaha, about three months since, which Council numbers over a hundred members already, and they represent the principal power plants in the great City of Omaha, we believe. Not only that, but they have brought a promising Council of the A. O. S. E. into lively existence, across the muddy river; namely at Council Bluffs. These Councils were organized in a straight forward manner, and not in any "underhanded ways" whatever. And there is certainly ground for grave doubt that the "Nationalists" will have as good a meeting as they might have, perhaps, if the upper hundred of Omaha steam engineers had joined their ranks instead of enrolling themselves under the banner of the "Americans."

That is not all. There seems to be a growing dissatisfaction in some of the branches of the N. A. S. E. against the "looseness" of their organization. And the bone of contention among themselves is the very point that forms one of the leading working principles of the A. O. S. E. They want their association to consist of engineers, and work for engineers, and engineers only. Their No. 28 branch, of Illinois, at Chicago, has been nicknamed "the silk-stockings" simply because they strongly advocate this principle, and they object to oil-men and rag-and-bone merchants among their members. The majority of the association, however, are for leaving the latch-string within reach of "whosoever will" to come in.

We hope those who will go to Omaha to have "a good time" shall not be disappointed. And evidently the Committee of Arrangements will do all, in their little power, to make the gathering a success. We are not given to prediction. And we can afford to wait until it is over before measuring the degree of its success or failure.

ELECTRICITY.

III.—THE GOLD LEAF ELECTROSCOPE.

As men made progress with electrical science, a a better apparatus, than the pith ball, was devised to indicate the presence of electricity, and at the same time show whether the electricity tested is positive or negative. This is shown in Fig. 2. This, however, is an improvement on the original electroscope (or electrometer, as it was first called). The original was invented by a reverend gentleman named Bennett, and is described by him as follows:—

"It consists of two slips of gold leaf suspended in a glass. The foot may be made of wood or metal; the cap of metal. The cap is made flat on the top, that plates, books, evaporating water, or other things to be electrified, may be conveniently placed upon it. The cap is about an inch wider in diameter than the glass, and its rim about three-quarters of an inch broad, which hangs parallel to the glass to turn off the rain and keep it sufficiently insulated. Within this is another circular rim about half as broad as the other, which is lined with silk velvet, and fits close on the outside of the glass; thus the cap fits well, and may be easily taken off to repair any accident happening to the leaf gold. Within this is a tin tube, hanging from the center of the cap, somewhat larger than the depth of the inner rim. In the tube a small peg is placed, and may be occasionally taken out. To the peg, which is made round at one end and flat at the other, two slips of gold leaf are fastened, with paste, gum-water, or varnish. These slips, suspended by the peg, and that in the tube, fast to the center of the cup, hanging in the middle of the glass, are about three inches long and a quarter of an inch broad. In one side of the cap there is a small tube to place wires in. It is evident that without the glass the gold leaf would be so aggitated by the least motion of the air that it would be useless; and if the electricity should be communicated to the surface of the glass it would interfere with the repulsion of the gold leaf, therefore two long pieces of tin-foil are fastened with varnish to the two opposite sides of the internal surface of the glass, where the gold leaf may be expected to strike, and in connection with the foot. The upper end of the glass is covered and lined with sealing wax as low as the outermost rim, to make its insulation the more perfect."

Singer made an improvement on this tester of electricity. Several other alterations followed. Fig. 2 is an engraving of a modern one. This consists of a glass vessel, of a shape somewhat similar to a bottle, without a bottom, fixed to a stand, and a cap or cork, with a piece of glass tube running through it and fitted in it tightly, is fitted to its mouth. "A circular disc of brass, about three or four inches in diameter, is now screwed on a piece of wire, the lower end of which is slightly flattened out on an anvil. The wire is then passed through the tube, the space round it being filled with shellac, and two small strips of gold leaf are gummed to the flattened end of the wire so as to hang side by side. Inside the cylinder, two strips of tin-foil connected with stand are pasted, so that, if a strong charge be imparted to the brass plate, the leaves may diverge [part from each other] till they touch these strips, and thus lose their surplus electricity. If now the brass plate has any degree of electricity imparted to it, it will at once pass along the wire to the pieces of gold leaf, and these, being thus similarly electrified, will repel each other, and stand apart, as shown in Fig. 2. The glass tube and shellac render the insulation nearly perfect, and thus, if the instrument be dry, the presence of even a very trifling amount of electricity will be at once rendered manifest. It is not even necessary or the electrified body to touch the plate, for holding it near will cause the leaves to diverge. With this instrument, too, we can tell whether the electricity is positive or negative. We first touch the plate with an exited tube. The leaves at once diverge, and as there is no means of escape for the electricity, they continue to diverge long after the tube is removed. Now bring the body whose charge we wish to examine near, and if the leaves diverge to a greater extent than before, we see at once that it, like the glass, is positively electrified. If on the contrary, the leaves have a tendency to diverge less, we know that the body is negatively charged."

There are several far more perfect instruments for this purpose on the market, to which we may refer further on. What are called electroscopes will indicate the pressure and kind of electricity. Electrometers "measure its quality," as one eminent author puts it; but it would be more correct, in the present state of American literature, to say "quantity or intensity." It is very easy to understand the outside characteristics of these instruments. But our aim, at this stage, is to try to lead our readers to understand the whys and the wherefores, instead of merely taking charge of instruments, and start at the beginning of the paths of investigation which have led men into close contact with the mysteries of electrical development.

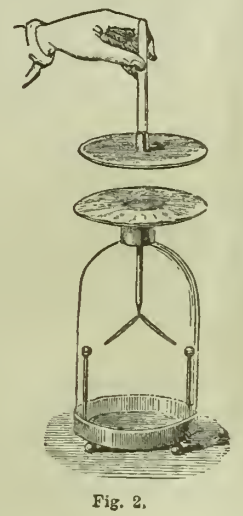

Fig. 2.

An electroscope, for experiment, such as shown in Fig. 2, may be easily made. Nearly a yard of gold leaf may be procured for half a dollar. Only a couple of small strips are needed, however. But common Dutch metal would do, instead of the gold leaf. If a brass plate cannot be readily obtained, a plate of zinc or tin may be used, and such a plate will work very well if the edges are made as smooth as possible. A lamp chimney, or a wide-mouth bottle or flask, may be substituted for the receiver; but a small opening would have to be ground at the bottom of the bottle or flask, so as to admit a narrow piece of tinfoil to join the strips pasted on the sides.

IV.—DYNAMIC OR VOLTAIC ELECTRICITY.

Hitherto we have treated of frictional or statical (or common) electricity. Electricity is evolved by other causes. Some minerals become electrified by being heated; or rather their electricity is perhaps decomposed, so that the negative and positive become separated. It was observed that crystals of tourmaline, when placed in hot ashes, repel particles of dust around them. A piece of warmed tourmaline fixed to a glass rod, or suspended by a silk line, shows electrical effects clearly indicated when brought to the plate of the electroscope. Several minerals and artificial crystals become electrical in the same way. Electricity developed by means of heat is called pyro-electricity. And substances which become electrically polarized, when heated, are called pyro-electrics. These generally exhibit opposite charges of statical (stationary) electricity at two separate parts, especially the two extremities.

The tourmaline also exhibits electrical properties by friction, and when two pieces are rubbed together one becomes positively and the other negatively electrified. The pyro or heat electricity of the tourmaline is distributed over the crystal almost in such a way as on a cylinder conductor electrified by induction (of which we will treat presently). The positive character of it is highest near one end of the crystal, and diminishes gradually towards the middle, where it ceases. Further on negative electricity is manifested, which increases gradually until it reaches its maximum near the other end. A peculiarity of tourmaline is that when broken in pieces, while electrified by heat, each piece will have a positive and negative pole. It is supposed that some chemical action takes place when electricity is produced by heat. However that may be, the actions of various chemicals produce dynamical (or moving) electricity.

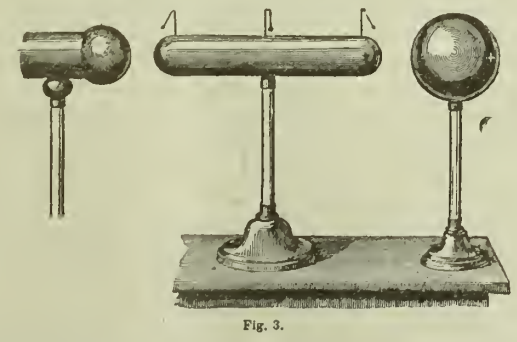

Fig. 3.

The current produced by chemical decomposition of certain substances, like that from a voltaic battery, is the movable or dynamic electricity which keeps on in a circuit, large or small, as long as the chemical action continues. It was Alessandro Volta who first devised an apparatus to produce electricity by means of chemical action. A Voltaic battery is constructed in various ways, consisting of a series of pieces of different metals, such as copper and zinc, arranged in pairs, and subject to the action of a saline or acid solution. A current of electricity is generated whenever the two poles, or ends of the series are connected by a conductor. A galvanic battery is thus formed.

What is called a Voltaic pile consists of a vertical series of discs of copper and zinc, placed alternately, with discs of cloth or paper moistened with acid water between them. Pieces of silver would have the same effect as copper, in conjunction with zinc. For instance, a round piece of copper is placed at the bottom, then a round piece of acidulated cloth (or paper), and on that a round piece of zinc. Then cloth, copper, zinc; cloth, copper, zinc; and so on, until about a dozen pairs of copper and zinc are piled up. And when the zinc at the top is connected with the copper at the bottom, chemical action takes place, and moveable or dynamic electricity is developed. Decomposition takes place in the pile. The points at which the electricity enters into, or passes out of, the substance suffering decomposition, are called the *poles*. Faraday called them *electrodes*. He also gave the name of *anode* to the point at which the electric current enters, that is the negative extremity of the decomposing body, or where oxygen, chlorine, acids, etc., are evolved, and *cathode* is the name he gave to the positive extremity.

Why such a result should follow the placing together of various metals, in such a way, cannot be explained. In the prophetic age we read of one healing the waters with a piece of iron. And so late as the latter part of the last century, and the first half of this, there was an instrument used in medicine which they called magnetic tub (*baquet*), and which was regarded with awe by those who sought its aid to heal their diseases. This tub, which was profanely designated as the devil's kitchen, lost its enchantment when Baron Chas. Von Reichenbach declared that "the magnetic tub is nothing but a chemical operation." It seems that various metals were placed in a tub "mystically stratified one above another." The mixture consisted of iron slag, broken glass, hammerings of iron from a forge, roots, iron ore, grains of corn (cereals), sulphur, sawdust, glass plates, wool, pieces of old iron, aromatic vegetables, and quicksilver. This afforded a "constantly persisting fountain" from which healing virtues were "made to flow to the patients through the conductors."

V.—INDUCTION.

It is hardly necessary to say that contact between two bodies is not requisite in order to make them electrical. The pith ball is electrified without the excited glass tube, or sealing wax touching it. It was in fact, understood, in the earliest days of electrical investigations that the force or agency that electrifies does the work without contact. It is done by induction. And there is scarcely any electric operation in which inductive action does not come into play. The mechanical effects produced in this way, that is by inductive action, are the most important in the whole range of electrical science.

An apparatus to demonstrate some of the leading features of the law of electrical induction may be made after the manner indicated by Fig. 3, which consists of three cylinders (two being but partly shown in the cut) mounted on glass rods, to ensure insulation. These cylinders must be made of some conducting material. Brass is frequently used. A cheaper apparatus may be constructed, by making the cylinders from pieces of wood, in which case all roughness should be removed, and the ends carefully rounded. The wood should be evenly coated with thin tin-foil, which should be rubbed smooth with a piece of ivory or bone; or an old tooth-brush handle would do. And common

paste will do to stick it on with. At each end of each cylinder, and also in the middle, a piece of wire should be fixed, with a pith ball suspended therefrom by cotton thread, as shown in the middle part of Fig. 3. The cylinders should be placed end to end so as to almost touch each other. Then if a highly charged body be brought near one end, the pith balls at the ends of each cylinder will rise immediately, while the balls in the middle of each cylinder will remain still. By touching a little gilt disc, fastened to the end of a glass rod, on various parts of the cylinders, and then bringing it near an electroscope, it will be shown that the end of the cylinder nearest the highly charged body will be electrified negatively, the other end being positive, while the middle remains neutral.

The great fact shown by such an experiment as the foregoing is that the exciter is not brought in contact with the cylinder, but the electricity in it is carried to the nearest cylinder by induction, and then from one cylinder to another without any contact between them. Another important fact, that should not be lost sight of is this, namely that induction is not manifested except when there is a non-conducting material between the charged body and the cylinder. In the experiment shown in Fig. 3, the air is the non-conductor, but thin sheets of glass or pieces of mica will have the same effect. That is, instead of leaving the cylinders apart, and leaving a space between the charged body and the cylinder, filled with air, the cylinders and the charged body, or exciter, may be brought so close together as to have only a thin sheet of glass, or some other non-conducting material between them. A thin sheet of metal, which is a conductor, or even wire gauze, would put an end to induction.

This is one of those important facts which, having been discovered by observation, has been applied in the construction of modern dynamos, in which the electrified segments of the commutator are thoroughly insulated from each other by mica, or some other non-conductor. But more of this anon.

We may remark here that this inductive element has caused serious trouble between telephone and electric railway companies. The current for operating electric railways is much stronger than what is required for telephone service. And where electric railway and telephone wires have run parallel, although a considerable distance apart, the stronger current of the electric railway conductor has swept all before it, and taken up the telephone wire by induction, thus rendering the latter useless. According to the latest legal decision, the telephone people have no claim against the electric railway men for damages. The law for a time was that where the telephone wires were the first occupants of a street the electric railway men who came after, were required to complete their circuits by return metalic conductors, or keep their current within bounds some other way. But now it is held that, inasmuch as the streets were primarily intended for travel, either on foot, or by vehicles, the electric cars have the superior right, whether they come first or last. And if their current is induced to pass over the telephone wires, it is for the telephone companies to provide a remedy.

This inductive force has also been prostituted for fraudulent purposes. Board of trade and stock-exchange quotations have been surreptitiously obtained by placing electrified wires parallel to telegraph wires, and by induction messages have been stolen. Where the legitimate wires are underground, this scheme cannot be carried out, without being easily detected; but where a telegraph wire is elevated, and especially where it runs near the roof of a building, a wire duly charged may easily be placed so as to take the message from the main (legitimate) wire by induction.

As shown in the kind of experiment to which Fig. 3 refers, one end of the cylinder is full of positive electricity, and the other end full of negative electricity, while the middle is "neutral." Not only that, but it is also a fact that electricity is distributed over the surface of an electrified body, and on the outside of wires or other conductors. And this mainly depends upon induction. This becomes quite plain if we take a hollow cylinder, made of any conducting substance, such as tin, and have it highly charged with electricity, so that sparks are freely emitted from its exterior; its inside will show no signs of electricity. And more than that, if we take such a cylinder in its natural state, that is not electrified, and place a charged ball inside it, the electricity will at once pass to the outside of the cylinder. But if a metal ball, connected with the ground, be placed inside the electrified cylinder, without allowing it to touch it, there will be such special induction as to cause the presence of a quantity of free electricity on the inside surface.

But with such an exception as that just mentioned, electricity always exists on the outer surface. An able experimenter relates that "a large metallic box was insulated and highly charged, so that sparks were freely given off from its surface, and yet, when a person with a delicate electrometer got inside, no effect at all was produced on him or on the instrument, So, too, a powerful battery may be discharged through a large case, inside which a person is concealed, without his feeling it in any way. A simpler experiment, proving the same fact, is to mount a cylindrical or egg-shaped body on an insulating stand, and provide two hemispherical caps which, together, just fit it. These should be fixed to insulating handles. If now we charge the globe, and then place the covers on it, and quickly remove them, we shall find that all the electricity has left the globe and passed into the covers."

It is on account of this fact that the capacity of a conductor depends on its outside surface. A solid wire and a tube of the same material, and of the same outside diameter, will convey the same electric current. The quantity (amperage) and the force (voltage) of an electric current are often compared with the volume and flow of water in a pipe. The water, however, runs through the space inside the pipe, whereas the electric current is distributed over the outside of the wire or other conductor. And the larger that outside surface is, the greater will be the quantity of electrical force transmitted.

CORRESPONDENCE.

Valley City Council, No. 2, Mich.

To the Editor of the American Engineer:

Sir:—Our first meeting this term was notable for some very welcome changes inaugurated by our new chief engineer, Bro. Stephen Christie. And if his plan should be faithfully carried out, every member of our Council may be benefited immensely. But there must be co-operation. And nothing but indisposition or urgent business should keep a member away from the council meetings. "Knowledge is Wealth," and by carrying out the plan outlined by Chief Christie, each member may realize five dollars' worth for every cent he has paid in.

Committees were appointed on certain appliances and principles, to gather all information concerning same and then write out essays thereon, such essays to be read at the council meetings, and then filed and preserved for future reference.

For instance, Bro. Balcomb was appointed on the standard thread for bolts, nut and bolt, and steam light bolts; how they became standard, how tested, etc. Bro. Triggon on the governor, its action and function, and the advantages of the various kinds of governors in use. Bro. Moore on the sprocket chain and belting. And Bro. Nevers, as librarian, to attend to the reading matter.

Good use is made of the black board at all our meetings. And we learn a great deal every time, and obtain much food for reflection at every meeting.

We wish to express our hearty thanks to the manufacturers who have kindly sent us prints, cuts, photos, etc., of their engines and boilers.

Bro. Christie is likely to lead our Council to become a model one. And our enthusiasm is being worked up, so that the appetite of our minds is becoming quite large. Yours fraternally,

C. M. Baker.

A CORRECTION.

In our issue of the 4th inst. Mr. O. Thum's name should have appeared, instead of C. Shrine, in Mr. S. Christie's article on "A Genius." Mr. O. Thum is the famous chemist and druggist of Grand Rapids.

Sixth Annual Meeting.

SUPREME COUNCIL, A. O. OF S. E.

The sixth annual meeting of the Supreme Council, American Order Steam Engineers, is being held at Syracuse, N. Y., as we go to press. We can only give a condensed report of the proceedings of the opening days. They convened on Monday, the 13th, at the rooms of the John E. Sweet Council, Klein Block, under the able presidency of Supreme Chief Engineer Jefferson Young, Jr., who lost no time in appointing the various committees, after the minutes of the last Supreme Council meeting had been read and approved. The chief delivered his annual address, and the delegates presented their reports, which were generally very encouraging. After the morning session the Council adjourned till 8 a. m. Tuesday morning. And our special correspondent "on the spot" writes at 3 a. m. Wednesday moruing: "The Supreme Council has just adjourned (3 o'clock in the morning), to meet again at 8 a. m., after an earnest and almost continuous session since 8 o'clock yesterday morning. The public meeting in the Alhambra hall on Monday was a great success."

The members of the Supreme Council, after a short session on Monday morning, assembled in the Alhambra at 2 o'clock in the afternoon to inspect the fine display of steam engines, pumps, boilers, specialties and general supplies which had been placed there for public exhibition. The afternoon, thus pleasantly and profitably spent, passed off swiftly, and when the members scattered to their hotels, to prepare themselves for the grand opening of the Fair, which was fixed for 7:30 p. m., they had no time to lose. Those who put in their appearance on time were Chief Supreme Engineer Jefferson Young, Jr., Supreme First Assistant Engineer Jerry Leahey of New Jersey, Supreme Treasurer James E. Deas of Connecticut, Supreme Recording Engineer Charles E. Jacks of Massachusetts, Deputy Supreme Chief H. K. Stroud of Minnesota, J. J. Wilson of Nebraska, Eben B. Hill of Missouri, C. M. Baker and T. M. Thompson of Michigan, Frank S. Neal and A. B. Southwell of Ohio, John Oswald of California, A. M. Robertson of Iowa, E. H. Maskcey of Minnesota, James Lightfoot, E. J. Calloway, Frank Weidner and Harry Horn of Philadelphia, Merrick Cowles of Illinois, representing The American Engineer official organ of the Order), W. F. Barrett of New Hampshire, Bernard Born of Massachusetts, H. G. Connors and H. R. Knowles of New Jersey, Charles H. Avery of Geneva, and John W. Teller, A. W. Radley and H. P. Roberts of Utica.

Among the distinguished visitors were Mayor Cowie (Syracuse), Prof. John E. Sweet, and Lieutenant Governor Jones (New York), Mayor Cowie presided. The attendance was large and enthusiastic.

The meeting was opened with prayer by the Rev. Mr. Johnson.

The mayor expressed his gratification at the fact that he was to preside over such a meeting. He couldn't think of a pleasanter duty, he said. From what he had learned of the American Order of Stationary Engineers he was sure that a better body of men did not exist anywhere. One of the main objects of the order was to develop the professional skill of its members, and as between them and the general run of men he should say that they were the people who knew something.

Supreme Chief Engineer Jefferson Young, Jr., followed the mayor's address with a fine oration on the aims and purposes of the Order. He began with the remark that this was the happiest moment of his life, and then went on to tell his audience why. It was only five years ago, he said, that sitting in an engine room in the city of Brooklyn he had dreamed of this organization. The order was planned by four men. In April of 1886 the banner of the American Order of Steam Engineers was swung out from the house at No. 457 Bond street, Brooklyn, with the principles of the order inscribed upon it. They built a castle in the air, and it was a solid building now. They were proud of the Order. It had become worthy of the name of American. Everything about it was and always had been and always would be American. One of its fundamental principles was never to take part in

strikes or allow itself to be used for political purposes. The members believed that ability would always bring its true value in this country. Strikes were cowardly, and they were un-American, and, besides, the workingman paid for them every time. The American Order of Stationary Engineers recognized an identity of interest between employer and employee. "Brain will win," and "Our employers are our best friends" were mottoes that they always kept in mind. The spirit of the order was benevolent. Its sick were cared for and its dead were buried. The steam engineers were not a selfish class. They believed that one of the duties that God had imposed upon them was to assist their brethern in every way possible. If one had more brains than another it was his business to help the other along. That was a part of their religiou, and if any of them failed in it they might find themselves in another engine room after their earthly career was closed.

Lieutenant Governor Jones then "held forth," and was well received. "I have been sitting here," he began, "listening and trying to think out why I was invited here, and I have just made up my mind that it's because I'm the Chief Engineer of the State and my presence was desired as an assurance that the sympathy of the people is with your Order."

The Lieutenant Governor went ou to say that he had been asked to speak on "Fraternity" perhaps because he belonged to so many fraternal societies, he thought. Continuing he said: "When your chief engineer asked me to come here and talk to you he told me of the principles of your Order. In so doing he knocked out a life-long impression. I have always believed that everything in this world had two sides, and one of those sides to be a good side and the other side to be a bad side. I now find here an organization with only one side and that side the right side. I believe in taking care of the sick and in burying the dead, but your society has a nobler object yet than this. I believe in fraternal organizations as a necessity, such fraternal organizations as yours here. There has grown up in the world a selfish class, a class that will crowd any man to the wall if it can. It is against this class that you are to contend. I believe in fraternal organization, not as aggressive bodies to carry war into the enemy's camp, but as bodies built for defenses. When you are well grounded in your faith that you are right then you are in a position to demaud your rights. The world is selfish iu general. The more money we acquire, the more glory we attain, the more power we have the more money and glory and power we want, and the more we believe that the world was made for the saints, and the more we believe that we are the saints. It is our duty in fraternal societies to work against this, uot by anarchy or communism or war, but by education. Don't speud time in wishing for the rich man's gold or in trying to steal it, but go to work earnestly and put yourselves where you will uot need it. Money can do most things in this world. It buys nominations, secures elections and places judges on the bench—almost everything but save life. But there are many things that you can do that money can not do. Not all the money in the world can make the rich man's son do what you can do without brains. The rich man's money can not buy capacity."

Here the Lieutenant Governor told a little story of a rich man who had a son at school. The rich man visited the schoolmaster and asked him how the boy was getting on in his studies. "Very well," replied the schoolmaster, "only he lacks capacity." Thereupon the rich man pushed his hand iu his pocket and exclaimed "capacity! If he wants capacity get it for him; I can pay for it."

With a few words of thanks for the attention of the audience the Lieutenant Governor withdrew to a seat at the side of Mayor Cowie, but he immediately rose again and stepped to the front of the platform. The vast audience held their breath, expecting that he was going to say something more. But he simply poured out a glass of water and drank it, which made the people laugh. The Lieutenant Governor thought they had nothing worth laughing at, and then dropped a remark which made them split their sides almost with laughter. As he finished drinking he said: "I noticed that all the previous windmills were run by water power."

The Justice of a License Law.

"The chief address of the evening," as the *Syracuse Standard* describes it, was the one by Prof. John E. Sweet who spoke upon "The Justice of a License Law." The securing of the passage of a license law has ever been one of the chief objects of the Order. Prof. Sweet said:

Honorable Chairman, Welcome Delegates and Fellow Citizens:

We call this a free country; we call ourselves a free people; we call this a democratic government, aiming to do the greatest good to the greatest number; we call it a republic, where the majority of the voting population are supposed to decide what shall be the laws of the land, or whereas it becomes inconvenient for each voter to vote upon each law, we select, from among ourselves, such men as we suppose to have acquired more or less of the sublime art of governing the country, to make the laws for us.

But if it is a free country we are not free to kill whosoever we please; or at least, we are not free to do so only in particular ways, and one of those ways, up to the present time, in this State at least, is by the use of steam boilers.

If you have an enemy and you wish to dispose of him, and you proceed by any of the ordinary methods, in the simple form of the manly art of self defense, with weapons of peace, or weapons of war; with fire, water, or with dynamite; by poison, practice upon him with quack medicine, or in almost any way, except by a steam boiler, and law will lay its sacred hands upon you, but, get him and his family, his friends and relations, or the neighborhood around a steam boiler and blow them up and it is an accideut, a crime that receives no punishment.

If you kill a man with your fist, they will find your sore nuckles; with a stone, they will find the stone; if with concealed weapons they will find the weapons, the place you bought them, the pistol with a missing bullet, the knife with blood, or the bludgeon with hair upon it. If you burn them up they will trace the matches, if you drown them they will trace your tracks. If you use poison or dynamite they will find where you bought it, and the detectives will follow you to the end of the earth, and the coroner will find a motive, society is up in arms, human life is sacred, the crime must be aveuged, you pay the penalty and are electrocuted.

But go at it with a steam boiler, and if you escape the boiler there is no danger but you will escape the law. It's an accidcut, no motive, no one to blame, experts disagree, the boiler was perfect, it was full of water up to the third gauge, and there had been no unusual fire under it. It just exploded.

"A democratic government." "The greatest good to the greatest number." To give the poor man a job at the lowest wages, handling a torpedo that he knows nothing about to satisfy the proprietor, who is not willing to pay for a man who does, the democratic principle is set at naught, the greatest good to the owner, starvation wages to the coal heaver and the greater uumber can take care of themselves.

The Republican principle that the majority should rule is all right when they will take the trouble to find out what they want and what they do not want. But they will not take the trouble, and whoever undertakes to lead them to think and reasou must expect opposition and subject themselves to ridicule.

Argument will be met by argument, petition by counter petition, and a proposed law, however just, however largely iu the direction of the general interest, whatever the reason, whatever right, if it is to interfere with the monoyed interest of any individual, or company, or industry; that individual, that company aud that industry will be arrayed against it. I have not taken the trouble to examine the statistics, but it will answer the purpose if we guess that a boiler explosion occurs in this country on an average of every day in the year, and serious enough if we say there is at least one person killed at every explosion; aud yet, *while there was never a nonpreventible boiler explosion in the history of the world*, and while every death is a *murder* or a *suicide*, indictments are seldom heard of, aud the first conviction yet to be made.

Boiler plate, which should be of the best material that the present state of the art will produce, is made to almost any degree of cheapness to meet competition. Boiler designing and building, which should be controlled by the most able skill or extended experience, is from its disagreeable nature too often left to unskilled hands; and worst of all, through the Cheap John disposition, or unfortunate poverty of proprietors, their management is left to the man who that not only knows nothing of the construction or safety of the torpedo he is handling, how to manage and care for it, and worst of all, one who is entirely incapable of comprehending the euormous energy stored up in the silent envelope under his guidance.

"Life, liberty and the pursuit of happiuess" is just as seriously interfered with when a man is blown into eternity by a steam boiler explosion as in any other way, and "life, liberty and the pursuit of happiness" are among the things the law attempts to secure to every man.

Human life is cousidered so sacred that in case a man is arrested for any crime where the penalty is death, the law will not allow him to hazard his life by a simple pettifogger's defense. If a man tries to take his owu life and fails the law steps in and punishes him for that. If you are sick the law says you shall not trust your life in the hands of a "quack." While the laws aim at the public good, they were not demanded or urged by the public who are beuefited by them, but by the men who could see a financial advantage to themselves by so doing. The law that no man shall be allowed to swear you "to tell the truth, the whole truth and nothing but the truth," and when you go to do it "objects" and that no man shall be allowed to brow-beat a witness unless he has been admitted to the bar, was passed under the pretence and likely with truth that it was for the public good, necessary for public safety and for the protection of human life.

The law that no man shall be allowed to practice medicine, heal the sick, glue broken bones, pull teeth, give poison or bread pills and collect his pay for it, unless he has a legal diploma so to do, was not promulgated or urged by the public and it may be questioued whether by the men who had only the public good at heart, but more likely by the profession, who could thereby shut out the quacks, maiutaiu remunerative prices and do what was perhaps even a more important thing for themselves, elevate the dignity of the profession.

Human life is often sacrificed by the falling of insecure buildings. Buildings are insecure because of improper design or defective construction. The architectural societies are moving for a law to prohibit incompetent men from practicing architecture and the cities elect supervising architects to superinteud construction with every endeavor to prevent the erection of dangerous buildiugs. There is as great a reason why the architects shoud succeed as the lawyers and physicians.

And if human life is as sacred when in the danger of boiler explosions, as in iusecure buildings, quack medicine or bad law, then as there are many more lives sacrificed by boiler explosions than iu the verified cases of the other three combined, there is all the more reason why the law should reach out its protecting hand and do what it can to relieve the public from the dangers surrounding this indispensable factor in human progress.

One of the aims of the American Order of Steam Engineers is to urge the passage of a law requiriug the owners of steam boilers to intrust their handling in the hands of such men and such men only as cau give evideuce of ability and reliability in their mauagement, and to meu who can give evideuce of ability to judge of the safety of the plant they attempt to manage.

The attempt to get such a law passed, however just, is liable to meet with streuuous opposition. Not only the opposition the lawyer met iu the pettifogger, aud the doctor in the quack, and which the engineer will find in the careless coalheaver, not only the opposition from the meu who can see an increase in price and claim that his freedom is interfered with, when he cannot get $2 worth of work out of a 75-cent man, but you who look forward to the enactment of the license law for stationary engineers, with such examinations as the United States insists upon being passed by every engineer

who handles the throttle, on every steamer sailing on her waters, are liable to meet with a more formidable foe than either of those before mentioned, that is a thoroughly organized foe, with plenty of capital and a working force at command, the boiler insurance companies. I do not say you will meet with this opposition, I only say you are liable to, and it is only giving them due credit for business shrewdness to anticipate the effort and the reasons to fear the result.

If there were no boiler explosions at all or danger from them there would be no boiler insurance companies. If there were twice as many explosions, there would be four times the demand, higher rates and only twice the damages to pay and the profits increased. Of course the boiler insurance companies would much prefer that it be the uninsured boiler, or one insured by some other company that would explode, still the remark of an agent that "we willingly paid the loss, as we wrote a half a million dollars insurance in two weeks after the accident occurred," would indicate that fatal boiler accidents are the great stimulus to boiler insurance.

While you are looking out for your own interests and circulating your petition to present to the Legislature, do not lose sight of the possibility that the boiler insurance companies, too, may be looking out for their interest, and while you are getting the names of able engineers and the endangered public to your petition, the boiler inspectors can get not only the names of all the engineers who are incapable of passing the examination, and many who can, but dread it, and all the proprietors who wish the lowest price man that will run his chances, and as many of the don't-care sort as he may choose to ask. All you can do to meet this formidable counter petition, if you meet it, is to have the facts properly set forth to the lawmakers.

There is another danger that must not be overlooked and must be avoided, and that is a conflict between sister associations aiming at the same end. You must not expect the National association to say we favor a license law for engineers in any form so it be a good license law, until you yourselves are willing to say we are in favor of a license whatever its particular phraseology, so long as it is a good license law. You cannot court the opposition of any one and succeed. If you cannot get it as you would like, get it the best you can and make it better when its defects are plainer and the change made easy. Do not forget, too, that this license law whenever enacted will strike both ways.

The license must be granted by a commission of persons delegated to grant licenses. For the law to be any use, this commission, or the licensing board, must be of men capable of determining the ability of the applicant, for unless they are, and perform their duty, it would be but a farce. The simple certificate of membership to some organization will be no passport, and while each delegate on his return urges forward the question of licensed engineers, let him also impress upon the members of his own local society the necessity of a thorough preparation for passing the legal examination.

The board cannot meet you all in your own engine room, however much better it would please them so to do, but they will be compelled to resort to a written or oral examination, and to meet this each must be drilled in the meetings, must study the books, must not only know the business and the principles, but he must know how to tell it. Urge upon your members the necessity of taking part in the discussions, buying books, small books—small books are better than large ones—books of such class as "Halsey on the Slide Valve," "Nemmingway on the Indicator," and of which there is no doubt many on boilers, pumps, heaters, etc.

As you work for the license law work to meet the requirements. Whatever you gain in self improvement you will always have; whatever you do toward a license law is in a good cause. While you will find money, self interest, ignorance and indifference arrayed against it, march on, admitting the self interest (for it cannot be disguised), but fight on for it, for it is in the line of human progress, the line of public safety; it upholds the sacredness of human life; it is the line of right and justice.

WIDOWS AND ORPHANS FUND.

Bro. C. E. Jacks followed Prof. Sweet. He spoke as follows:—

The subject of Widows and Orphans Fund has been given me this evening, and as we live in the 19th century where we inherit these valuable and important trusts, all societies and religious bodies have taken them as trusts and marked plainly upon their walls, in letters of gold emblems of their rule and guide, faith, hope and charity; while they are significant in their way to me they are but cold terms that bring but slight assurance to the widows and orphans in the life they live and I think the translation must be in error and the true text should have read "love and sympathy" instead. For Christ taught only the lesson of love and sympathy and commanded us to "learn to love" and as we are children of God love abounds in the human heart, but it has been made secondary in life by the terrible selfishness of man.

Therefore it becomes necessary in laying the corner stone of any great undertaking to have emblems symbolical of the lessons to be fostered and cheerfully granted that they may prosper in the land, and to-night I can tell you that we, as you have already listened to, are purely Americans in principle and I will tell you that not only are we Americans but we adopt the principles of love and sympathy as our emblems that we may not only cheer but encourage the widow in the struggle for a living that she shall the better be the rule and guide of the orphans. And the orphans shall grow up in an atmosphere of love, sympathy, indulgance, to a nobler manhood to the glory of God, a light and pleasure to all that may come within their circle, for we, as an association, have the true principles as we believe in education and the building up of men rather than tear down. We feel that we would have the help of all men in this noble course to the end that we live as one great harmonious family knowing no sect or creed, no position, no division, laboring together to help build up one another, forgetting self in the labor of love, and then only shall Heaven and earth meet and the glory of manhood be exemplified, and you shall enjoy as it were a vision of Heaven upon earth.

The sun will shine with an increased splendor, the trees will nod you a welcome as you pass by, and the birds will sing their sweetest songs, while the flowers will regale you with their richest perfume and life will be worth the living.

We also include an accident clause, whereby we look after the interest of those that may become incapacitated from earning a living. We also are interested in establishing a home for such, as well as the orphans.

We also believe in changing the usual custom "see the good in man and woman, rather than their faults." And these emblems, with the Flag of our Order are written with words of fire upon its walls, "Love and Sympathy," that all shall receive because it is their just due rather than under the erroneous "Charity," for it is a life of love we lead, and all we ask is your support, a kind word and your approval.

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The meeting evidently created quite a stir, and the reports thereof occupied a large space in the daily papers. "Got a full head on" was the blazing caption of the report in one paper. Another figurative description was somewhat more scientific, which said, "The engineers steam up at the Alhambra; they are running at high pressure, but the safety valve is all right; Mayor Cowie and Lieutenant-Governor Jones and Professor Sweet in the Cab."

The Fair, or Exposition of steam appliances was a very creditable one. The exhibitors are the Acme Oil company; the Pierce, Butler & Pierce Manufacturing company; the Syracuse Supply company; the Straight Line Engine company, and Edward Joy, of Syracuse; the Chapman Valve Manufacturing company, of Boston; the Safety Manufacturing company, and Jenkins Brothers, of New York, and the Wheeler & Tappan company, of Chicago.

THE HARRY HOHN FUND.

Contributions to the Harry Hohn Fund should be forwarded to the treasurer, Franklin R. Moore, 727 Filbert St., Philadelphia, Pa. He reports receipt of the following:—

Amount previously acknowledged,	$144.20
John E. Sweet Council, No. 6, of N. Y.,	8.50
Jefferson Young, Js., Council, No. 13, N. Y.,	6.25
	$158.95

BOILER EXPLOSIONS ACROSS THE WATER.

Boiler explosions are still in order in England. The following is the report of what occurred at an official enquiry into the circumstances of a boiler explosion underground, as published in *Engineering*. Then follows a report of an enquiry concerning the explosion of a bleaching kier from the same contemporary. The facts are certainly "instructive:"

Two "formal investigations" by the Board of Trade under the Boiler Explosions Act, 1882, have just been held, and the facts brought to light are instructive, and well worthy of attention by boiler owners and those interested in the use of steam.

The first of these investigations took place at New-castle-on-Tyne, and had reference to the circumstances and cause of an explosion which occurred on Saturday, April 11, at the Usworth Colliery, owned by Messrs. Bowes and Partners, Limited. The Commissioners were Mr. Howard Smith, barrister-at-law, and Mr. I. Hallett, consulting engineer. Mr. K. E. K. Gough appeared for the Board of Trade, Mr. Cooper, solicitor, for the owners and the manager of the colliery, and Mr. Newlands for Mr. George Elwen, the engineer.

The boiler was one of a series of three, of the double-flued or Lancashire type, 20 ft. long, 6 ft. 6 in. in diameter, made of steel plates ½ in. thick, double riveted at the longitudinal seams, and worked up to 60 lb. on the square inch. It was made by Messrs. Fowler, of Leeds, in 1883, but does not appear to have been put under steam until September, 1885. The boiler gave way on the right-hand side of the shell at the front end, and rent through three plates, which were turned over to the left. Being lying situated underground the damage to property was immaterial, but five men were injured, four of them fatally. The cause of the explosion was very simple, and one which would have been detected by a careful and intelligent inspection. Owing to the acid character of the pit water with which the boiler was fed, the plates at the water line for the whole length were dangerously wasted, and in some places were less than 1-16 in. thick. The boiler had been examined by the firm's engineer, who, however, was pronounced by the Commissioners to be "utterly incompetent" or "recklessly negligent." The owners were ordered to pay the sum of 100*l*., which is the highest sum yet levied at these investigations.

After taking the evidence of the various witnesses, including that of Mr. Jackson, engineer-surveyor to the Board of Trade, Messrs. Fowler's engineer, the engineer and manager of the colliery, &c., Mr. Howard Smith, the presiding commissioner, gave judgment. He traced the history of the exploded boiler which, when new, was tested to 120 lb., and the bursting pressure of which was calculated at about 500 lb. The boilers were fed from tanks in the shaft, 60 fathoms above them, the water having in its passage to the tanks percolated through the strata, which consisted principally of sandstone and a little blue or grey shale. The water had been carefully analysed, and owing to its acidity was not fit to be used for feeding the boilers. Two years ago, No. 2 boiler, the one which exploded, leaked,

and at intervals up to the time of the explosion, all three had leaked. Some time since the Galloway water tubes with which the furnace flues were fitted were found to be attacked by internal pitting and nearly all of them were removed in consequence. About six months before the explosion, Mr. Elwen, the engineer, and Mr. Wraith, the foreman enginewright, examined the boiler and found the plates at the water line corroded as much as $\frac{1}{8}$ in., the thickness then being $\frac{3}{8}$ in. instead of $\frac{1}{2}$ in. as originally. They passed a straight edge along the plate and said they ascertained how thick it was, but in the opinion of the Court it was not possible to ascertain the thickness that way. They also stated they sounded the plates with a hammer, but the Court considered that if they had been up to their business they would have detected the wasting by the sound. Mr. Elwen reported to the manager that the boilers had generally deteriorated at the water mark, but said that with proper attention "they would go for several years." Six weeks subsequently they again examined the exploded boiler, and again applied the hammer test. Mr. Elwen reported the corrosion to have increased, and Mr. Wraith considered that the plates at the water line had corroded another $\frac{1}{8}$ in. since the prior inspection, thus leaving them only $\frac{1}{4}$ in. thick. Since that time the leakage had been incessant, and on the night before the explosion the behaviour of the boilers was very bad, and No. 1 was laid off in consequence. Wraith reported this to Mr. Elwen, who deputed to William Bell, one of the men killed—who had previously been convicted of neglect of duty—the discretion of saying whether No. 2 should be stopped or not. The boiler was not stopped, and went on leaking and working, till the next day, when it burst, killing four men. The explosion was due to the plates being so wasted by internal corrosion as to be unable to stand the working pressure, and from an inspection of those plates the Court was surprised that they withstood the pressure so long as they did.

Mr. Smith went on to say that they were asked by Mr. Gough if blame attached to anybody. They were of opinion that no blame could be attached to the agent of the collieries, to the manager, or to the under-manager, but very serious blame attached to Mr. Elwen, the engineer. For a person in his position he was either lamentably ignorant, or if he had the necessary knowledge, he had been guilty of a most serious dereliction of duty. He reported to the manager that, in his opinion, the boilers would last a number of years, notwithstanding that he had just previously found out that they had corroded to a very considerable extent. His attention was called to the water, yet he did not take any steps to have it analzsed. It was astonishing, if he was as ignorant as he seemed to be, that he had ever ventured to take charge of a boiler at all. He had told the Court that it was a common thing to stop leaks with horse dung, and had confessed that he knew that the leak in No. 3 boiler was so stopped on the night before the explosion. The Court knew that in low-pressure boilers this was done, but they had never heard of it being done in high-pressure boilers such as these. They could not too strongly condemn the practice, which was a dangerous one. On the morning of the explosion, although he knew that the boilers were in a bad state, and that it might at any moment be necessary to shut off No. 2, instead of going down himself, or deputing a proper mechanic to go, he left the duty of determining whether or not the boiler should be continued in work, to Bell, who probably ought not to have been allowed to attend to any boiler at all. Under these circumstances it seemed to the Commissioners that throughout the time when Mr. Elwen was engineer at the colliery, assuming that he had the requisite knowledge, he had been exceedingly negligent in his duty, and that he was very much to blame for the explosion. Wraith they did not find to blame, he having reported fully to Mr. Elwen the condition of the boilers. The Court was of opinion, after very careful and deliberate consultation, that this must be described as a disgraceful case. There seemed to have been a great want of supervision, in fact, no supervision at all, and no proper management. The engineer was either an utterly incompetent man or else he had been a recklessly negligent one; and they must express their grave sense of the want of management and supervision. The owners of the colliery had made special rules, but what was the use of those rules unless they were enforced? Therefore, although it had been argued by Mr. Cooper that there was no *culpa* in the sense of wrong committed by the company, still, following the usual course in these matters, the Court would put in force the doctrine of *respondeat superior* and find that Mr. Berkley, as representing the colliery owners, was held to be blamed and responsible for the neglect of Mr. Elwen, their engineer; and they so found.

On this finding of the Court Mr. Gough applied for an order against the colliery company for the costs and expenses of the investigation.

Mr. Cooper objected to this, as he did not see why they should be called on to pay for the negligence of Mr. Elwen. The officials could have no personal responsibility with regard to him.

In reply the presiding Commissioner said there was no personal resposibility, but the Act of Parliament said the costs were entirely in the discretion of the Court, and they had always ordered the boiler owners to pay if persons in their employ had been negligent. The Court ruled that Mr. Berkley as representing the owners of the colliery, should pay to the solicitor of the Board of Trade 100*l.* as the cost and expenses of the investigation. If the costs were less the remainder would be returned.

This investigation is further of interest as showing the satisfactory working of the "Boiler Explosions Act, 1890." Before that Act, which was introduced last year by Sir William Houldsworth, M. p., was passed, boiler explosions at collieries were not investigated by the Board of Trade, but simply by the Home Office. Whatever information was obtained was practically hidden from the public eye, since only meagre details were published in the annual reports of Her Majesty's Inspectors of Mines. Now, however, such explosions come within the Boiler Explosions Act of 1882, and the present case is the second which has recently occurred at a colliery and respecting which a formal investigation has been held. The facts revealed show the necessity of the Act of 1890.

The second "formal investigation" to which we may refer was held at Bury, and dealt with an explosion which occurred on April 22, at the Longcroft Bleach Works, Walmersley, owned by Mr. Newton. The Commissioners were Mr. Howard Smith, and Mr. G. F. Bell, consulting engineer. Mr. Gough represented the Board of Trade, and Mr. Norton, solicitor, watched the case for Mr. Newton. Mr. John M'Killop, who was manager of the works at the time of the explosion, appeared in his own behalf. The investigation occupied two days.

In this case it was not a steam boiler which burst, but a kier, one of three, used for bleaching cotton yarn. It was a plain cylindrical vessel 5 ft. 8 in. in diameter by 5 ft. 11 in. high, made up of seven wrought-iron plates $\frac{3}{8}$ in. thick, with dished bottom attached by external angle irons. The plates were jointed together by outside butt straps 7-16 in. thick, single rivetted, with $\frac{3}{4}$ in. rivets pitched about 2 in. apart. The cover, which was also dished, was of wrought iron about $\frac{1}{2}$ in. thick with a cast-iron joint face rim rivetted to it. It was secured by, or rather had provision for, 15 bolts, the bolt holes being $1\frac{1}{4}$ in. in diameter, but the bolts used were in some cases, only 1 in., and in others less, in diameter. Sixteen bolts had originally been provided for, but one hole had recently been covered by a cast-iron hinge. The age of the kier was unknown, but the evidence showed that it was second-hand thirty years ago, but was supposed to be at that time nearly new. It was used for steaming yarn, which was put into it daily. The nuts of the cover were provided with wing handles, and it was the practice, after putting on the gasket joint ring, to screw down the nuts as far as possible by hand, and then to hammer round the wing handles until the joint was tight. This was exceedingly rough treatment for the bolts, and frequently they either broke or the threads became stripped. When the yarn was introduced and the cover fastened down, steam was let in from two Lancashire boilers working at 30 lb., but the pressure on the kier was lowered to 10 lb. by a reducing valve.

On Wednesday, April 22. when the kier had been at work for about an hour, the cover was violently blown off, doing some damage to the works. A man engaged near was blown over a wall 16 ft. high, on to the bank of a reservoir, into which he rolled but was fortunately rescued, and was found to have sustained a fracture of the skull. The manager also was slightly injured.

The cause of the explosion was the failure of the cover bolts, which were inadequate for the pressure carried. The kier was supposed to be worked at 10 lb, but some time before the explosion, the manager thinking the steam pressure was not high enough on account of the reducing valve not acting properly, tied down the lever of the reducer so as to admit the full boiler pressure. Only seven bolts could be found after the explosion, and all of these were broken asunder in the body. The cast-iron rim of the kier was fractured at several bolt holes. An examination of the reducing valve revealed the fact that some pieces of india-rubber had lodged within it, probably from an old pipe joint ring. This would account for the valve not working properly.

Mr. Newton, the owner of the works, gave evidence. No inspection had been made of the kiers. He had no practical experience with boilers, and trusted to his manager. Some repairs had been made by several engineering firms and he assumed all was right. No suggestion had been made to him as to the desirability of a safety valve on the low-pressure side of the reducing valve.

The Commissioners, in closing the first day's sitting, laid stress on the fact that no practical engineer or mechanic was engaged on the premises. Although it was contended that in small works it was not customary to engage fully qualified engineers, they submitted that, in any case, kiers as well as boilers should be inspected once or twice a year by a competent person.

At the second day's proceedings Mr. Newtou put in certain papers to show that he had done all that could be reasonably expected from him to provide for safe-working. Since he took the premises scarcely a week passed without his having some practical mechanic or engineer effecting some repairs. It was directly contrary to his instructions that the pressure in the kier was more than 10 lb. Though the action of his manager, who tied down the lever of the reducing valve, the pressure was raised to 30 lb., but that was without his knowledge or sanction.

In giving judgment Mr. Howard Smith said that Mr. Newton and Mr. M'Killop were each to blame. The court had grave doubts as to whether fifteen bolts were put into the lid of the kier to keep it down, seeing that only seven had been found. The explosion, in the opinion of the Court, was caused by the bolts which held the cover giving way, and the pressure of steam, which was proved to have been about 30 lb., accelerated the failure. Mr. Hoar had pointed out that the seven bolts which had been found were broken in the body and one had been torn from the head. The diameter of the bolts also was smaller than the diameter of the holes, but even if the bolts had been a true fit, the stress upon them was far too great. Mr. Hoar had told the Commissioners, and they agreed therewith, that the construction of the kier and cover was defective, that the bolts were insufficient in number, and that 10 lb. was the highest pressure at which it should have been worked, that being the pressure at which Mr. Newton wished it to be worked. With regard to the question of inspection, the Court held that Mr. Newton should either have examined it himself, or if not competent to do so, he should have employed a properly qualified engineer. A competent inspector would have told Mr. Newton that to insure safe working, it was necessary there should have been a safety valve fitted between the reducing valve and the kier, that was to say, on the low-pressure side of the steam pipe, in order that those in attendance might ascertain whether the reducing valve was acting or not. Such a man would also have advised the fitting of a steam gauge on the steam pipe between the reducer and the kier. There were extenuating circumstances in Mr. Newton's conduct, but the Court considered that the manager knew, or ought to know, that he should not have tied down the lever of the valve.

His excuse was that he relied on the assurance of Mr. Newton that the kiers would resist a pressure of 40 lb. The court accepted that statement in fa-

vor of Mr. M'Killop, although Mr. Newton had no recollection of having said so. Mr. Newton, however, had said that he did not want the kier worked at more than 10 lb. It was perfectly clear, therefore, that Mr. M'Killop was not justified in tying down the lever of the reducing valve, and he was to blame for so doing. They thought, too, that Mr. M'Killop did not take proper precautions to see that the bolts were in good condition, and that the cover was properly put on and effectually secured. The Court, therefore, came to the conclusion that Mr. M'Killop, as well as Mr. Newton, was to blame for the explosion. Since the explosion Mr. Newton had, they were glad to say, done all in his power to mitigate its effects. He had paid the wages of the injured man from the time of the explosion up to the previous week, when he was stopped from doing so for reasons which it was not necessary the Court should inquire into.

Mr. Gough, on this finding of the Court, asked that Mr. Newton and Mr. M'Killop should be ordered to pay the costs of the investigation, or a portion of them.

The Commissioners in reply said they would not make any order against Mr. M'Killop, on the ground that the employer was liable for his actions. They directed that Mr. Newton should pay the sum of 25*l.* to the Board of Trade.

This explosion affords a strong argument in support of the view now very generally held, that such vessels should be under competent inspection. Kiers, often of weak design, are extensively used in bleach and other works, and from time to time explosions have occurred with fatal results. It would seem but reasonable that some steps should be taken to insure greater safety in their construction, mode of treatment and general working.

Steam pipes are now made of ramie fibre, and the material is pressed so closely together by means of hydraulic machinery, that it has a tensile strength two and one-half times that of steel.—*Mechanical News.*

LITERARY.

The Cassell Publishing Company will issue immediately by arrangement with the English publishers, Miss Menie Muriel Dowie's book, "A Girl in the Karpathians," in which she gives an unconventional and racy account of her travels among the mountains of Russia—Poland. The book is illustrated with maps and bits of scenery and contains a full length portrait of Miss Dowie in flannel skirt, jacket, knickerbockers and Tam-o'-Shanter, as she traveled on horseback and alone through this wild region. Miss Dowie, who is in her early twenties, is the young lady who aroused the enthusiasm of the British Association by an address before that learned body on her return from her travels. "A bright, humorous, lively, unconventional, spoiled child," the *Review of Reviews* calls her. Her book is likely to make as great a success here as it is in England

SPECIAL BUSINESS NOTICES.

CONTRACTS OPEN.

Water-Works.—The Village of Madelia, Watonwan County, Minn., will let contract to the lowest responsible bidder July 29, 1891, at one o'clock p. m., for high tank and water mains. Right reserved to reject any and all bids. $9,000 to be expended according to the plans and specifications on file in Recorder's Office. C. COOLEY, Recorder, Madelia, Minn.

Dated June 27, 1891.

Sealed Proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D C., until the 30th day of July, 1891, for all the labor and materials to fix in place complete the low-pressure, steam-heating, and mechanical ventilating apparatus, etc., and the concrete floor of basement for the U. S. Courthouse and Post-Office building at Louisville, Ky., in accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Superintendent at Louisville, Ky. Each bid must be accompanied by a certified check of $500. Proposals must be inclosed in envelopes, sealed and marked, "Proposal for Low-Pressure, Steam-Heating, and Mechanical Ventilating Apparatus, etc., and the Concrete Floor of Basement for the U. S. Courthouse and Post-Office Building at Louisville, Ky.," and addressed to W. J. Edbrooke, Supervising Architect.

Sealed Proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock p. m. on the 28th day of July, 1891, for all the labor and materials required for the iron stairs, iron work, etc., of elevator shaft, for the U. S. Court House, Post Office, etc., building at Denver, Col., in accordance with drawings and specification, copies of which may be had on application at this office, or the office of the Superintendent at Denver, Col. Each bid must be accompanied by a certified check for $200. The Department will reject all bids received after the time herein stated for opening the same; also bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in envelopes, sealed and marked, "Proposal for Iron Stairs. etc., for the U. S. Court House, Post Office, etc., building at Denver, Col.," and addressed to W. J. Edbrooks, Supervising Architect.

To Iron Manufacturers.—Office of U. S. Lighthouse Engineer, Fifth and Sixth Districts, Baltimore, Md., June 30, 1891. Proposals will be received at this office until 12 o'clock m. of Wednesday, the 22d day of July, 1891, for furnishing the materials and labor of all kinds necessary for the completion and delivery of the metalwork of the Maryland Point Lighthouse, Maryland. Plans, specifications, forms of proposal and other information may be obtained on application to this office. The right is reserved to reject any or all bids and to wave any defects. J. C. MALLERY, Captain of Engineers, U. S. A., Lighthouse Engineer.

Pump.—Bids wanted for one duplex steam pump, 4-inch discharge. Water to be forced up an incline of 1,700 feet—perpendicular 45 feet—total height 100 feet. State number of gallons guaranteed per hour with 20-horse boilers, 50 pounds pressure, also one 20-horse flue boiler without firebox, including smoke-stack, gong, whistle, good size gratebars, boiler not less than 5-16 thickness of steel, also 2,000 feet cast-iron water pipe 4-inch, also 3,000 feet 6-inch cast-iron water pipe, four 6-inch elbows, one 4-inch elbow, elbows to be large in centre, 6-inch pipe to have connections for at least four fire hydrants, also six connections for 4-inch pipe. Separate bids taken. Send bids to Sam Walker, Milledgeville, Ga.

Water Works Extension, Section "H," Low Service Conduit. Sealed proposals for the public work hereinafter mentioned will be received at the office of the Board of Public Improvements, St. Louis, Mo., until 12 m. of the 21st day of July, 1891, at which hour they will be publicly opened and read, viz:

Letting No. 3,456. For making the required excavation and embankment and building section H of the Low Service Conduit complete in working order.

The following are the approximate quantities of the workt o be done, viz·

a 13,000 cubic yards excavation.
b 1,500 cubic yards borrowed earth.
c 3,700 cubic yards concrete.
d 2,200 cubic yards brick masonry.
e 18,500 square feet granitold.
f 100 lineal feet 36-inch cast iron pipe culvert.

Deposit required, $1,319.

Proposals must be made on blank forms furnished by the Board of Public Improvements.

The right to reject any and all proposals is expressly reserved.

Plans may be seen and specifications and forms of contract may be obtained upon application at the office of the Water Commissioner, room 27, City Hall.

By order of the Board, GEO. BURNET, President. Attest: Emory S. Foster, Secretary.

Viaduct. — Proposals for constructing a viaduct.—Rock Island Arsenal, Rock Island, Ill., June 23, 1891.—Sealed proposals, in triplicate, will be received until 2 o'clock p. m. on Saturday, July 25, 1891, for furnishing, constructing and erecting the iron and all other work complete, except masonry, excavations and fill, for a viaduct from south end of the Rock Island Wagon Bridge, between Rock Island and the city of Rock Island, over the railroad tracks which adjoin the approach to the said bridge, including the raising the said bridge to an inclination required to form a continuous roadway with the viaduct. Plans and specifications, with full instructions, stipulations, etc., and the blank forms on which proposals must be made, can be had on application to Captain M. W. LYON, Ord. Dept. U. S. Army, Commanding.

Water Pipes Etc.—Sealed proposals for the public work hereinafter mentioned will be received at the office of the Board of Public Improvements, St. Louis, Mo., until 12 m of the 21st day of July, 1891, at which hour they will be publicly opened and read, viz: Water Pipes. Letting No. 3,447. For furnishing and delivering at the City Pipe Yard, about 640 tons of six-inch and 12-inch cast iron coated water pipes. Deposit required, $523.

Special castings. Letting No. 3,448. For furnishing and delivering at the City Pipe Yard, about 15 tons of cast iron coated special castings. Deposits required, $75.

Stop Valves. Letting No. 3,449, For furnishing and delivering at the City Pipe Yard, about 19 six-inch, 12-inch and 15-inch stop valves. Deposit required, $90.

Laying Water Pipes. Letting No. 3,450. For making excavations and hauling and laying complete, in accordance with specifications, about 11,500 linear feet of 12-inch water pipe.

100 linear feet of six-inch water pipe.

Setting complete, eight fire plugs.

Furnishing 300 pounds of wrought iron straps, bands and bolts. Deposit required $238.

A separate proposal must be made for each letting on a blank form furnished by the Board of Public Improvements.

The right to reject any and all proposals is expressly reserved.

Specifications and forms of contract may be obtained and drawings may be seen upon application at the office of the Water Commissioner, room 27, City Hall.

By order of the Board. GEO. BURNET, President. Attest: Emory S. Foster, Secretary.

JULY 25, 1891. **The American Engineer.** VOL. 22, NO. 4.

BUFFALO PUNCH, SHEAR AND BAR CUTTER.

The Buffalo Forge Co., Buffalo, N.Y., have brought out a combination tool of much interest to a large number of our readers. The accompanying illustrations give a general view of the tool, its application to different uses, and also, by way of contrast, a picture illustrating the very old method of doing the work.

The Buffalo punch, shear and bar cutter is a machine that permits the operator to work it either as a punch, shear or bar cutter without a helper. Furthermore, no adjusting is required in changing the work, as the tool can be put to any of its uses at any time.

Special claims are made for power, durability and compactness, and it is said that experience has proved it to be a most satisfactory appliance. The tool is made in four sizes. No. 1 will shear ¼ inch strap iron 1½ inches wide; will punch ⅝ inch hole in ⅜ inch iron and cut off ⅝ inch. The No. 4, the largest size, will shear ⅝ inch strap iron 3 inches wide; will punch ½ inch hole in ½ inch iron, and will cut off 1¼ inches. All the parts of the machine are made to standard sizes, so that when put together they form a well fitted machine; and furthermore, the parts are interchangeable.

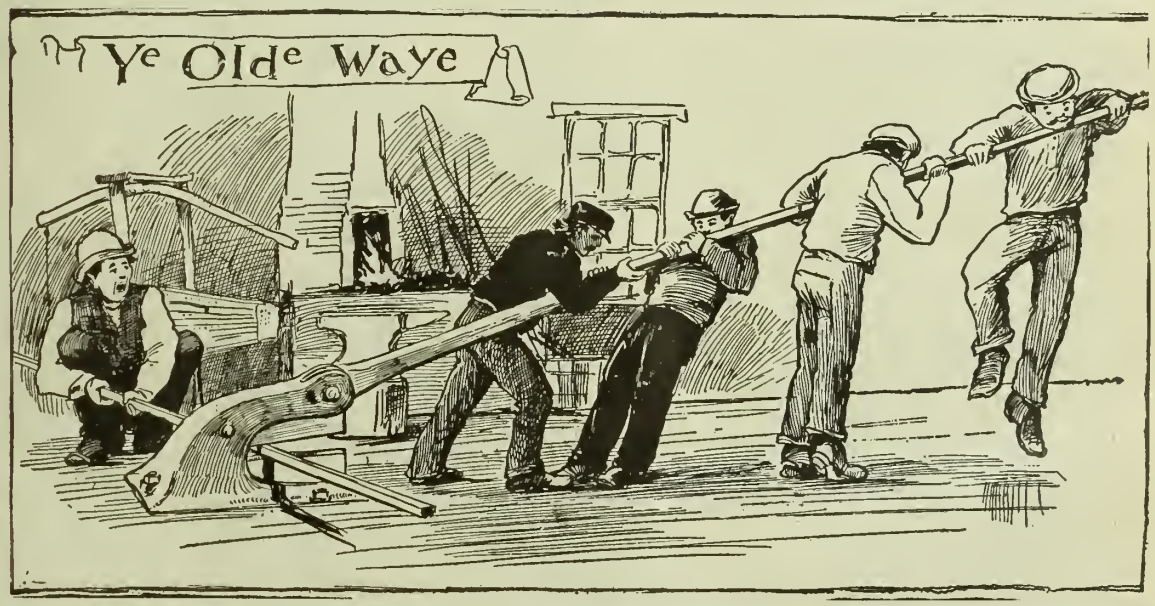
One machine is used for splitting iron; while another is employed for cutting round iron. The lower cut in the first column shows the machine used on flat iron, while that opposite illustrates its application for punching iron. The special mechanism of this combination machine, as referred to by manufacturers, consists in a combination of levers so that the cutting is done up from the bottom. This, it is said, enables one man to do more work than two men could with the old style down-cut machine, where the pressure comes down against a dead weight. Ye olde waye cut shows the old fashioned style of cutting iron, and suggests very strikingly the improvement that has been effected in this department of work.

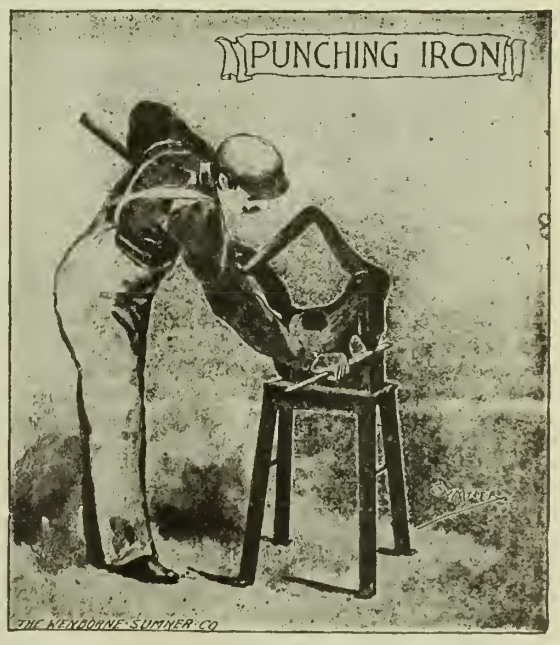
INJECTOR CHECK ATTACHMENTS FOR LOCOMOTIVE BOILERS.

Eight or ten persons were scalded to death, and others horribly tortured in a distressing train accident on the Colorado Midland Railway recently. It was a case of side collision, and the valve, which was unprotected, was broken off the engine, and a 2″ or 2½″ jet of water, at about 360 degrees Fahr., was poured through the windows into the passenger car, dealing horrible death and intense misery.

The common method of attaching injector checks to locomotive boilers is faulty and weak, says the *Railroad Gazette*. Locomotive builders know how different are the demands of purchasers in this respect. Some require large flanges cast on the checks, which are then fastened to the boiler by three or four ¾-in. studs. This plan is secure and safe in any ordinary collision, unless the checks project out from the boiler an unreasonable distance. The old and faulty plan of attachment is to screw the shank of the valve directly into the shell of the boiler. With this there is generally so little material left after the threads are cut on the shank that a light blow will break off the check, and sometimes the expansion of the check pipe will alone be sufficient to cause the check to crack off. Various rear collisions of freight trains and some of passenger trains have long since shown this construction to be bad, and for the last five years builders have been required by careful purchasers to put on the flanges just described; and to-day no master mechanic or locomotive builder who seeks to build a safe engine would think of using the old attachment, any more than he would now use the old combination stand in the cab or attach the steam piping to the structure of the cab, both of which practices have been discarded because of the inevitable breakage in minor collisions which lets out hot water and steam into the cab and scalds the men. There is no other detail attached to a locomotive boiler at the front end that is so liable to be broken off and that will allow so much hot water and steam to escape in a wreck as the injector check. All other parts are attached by solid studs which do not have holes through them.

It is impossible to attach an injector check to a locomotive boiler in any way that will withstand the force of the violent collisions which sometimes take place, but there is no excuse for their breaking off in minor accidents, for the practice of the most careful builders can be imitated by all. The additional expense is too trifling to mention. In addition to the adoption of a better manner of attachment, some roads have gone farther and changed the form of the check itself to one particularly adapted to ward off blows, and in which the projection from the boiler is much reduced. Others have provided a ball check valve in the interior of the boiler, which will close at once if the check is broken, just as the safety check closes on the best forms of water glasses in the cab when the glass breaks. Fatal accidents from ruptured pipes of the nature we are now considering are somewhat common, and the need of a better attachment than a screwed shank check projecting a considerable distance from the boiler should be well known; and as all locomotive builders know, or easily can know, of the preventive measures we have mentioned, there is no reasonable excuse for the continuance of the dangerous and inferior screwed shanks such as are still being sent out regularly by some of our shops.





UNCLE SAM'S FISH DISPLAY.

The World's Fair will have the greatest aquarium ever constructed. The fish exhibit at the World's Columbian Exhibition is to be a wonderful one, and not the least interesting portion of it, naturally, will be the aquarial or live fish display. This will be contained in a circular building 135 feet in diameter, standing near one extremity of the main fisheries building, and in a great curved corridor connecting the two.

In the center of the circular building will be a rotunda sixty feet in diameter, in the middle of which will be a basin or pool about twenty-six feet wide from which will arise a towering mass of rocks covered with moss and lichens. From clefts and crevices in the rocks crystal streams of water will gush and drop to the masses of reeds, rushes, and ornamental semi-aquatic plants in the basin below. In this pool gorgeous gold fishes, golden ides, golden tench, and other fishes will disport. From the rotunda one side of the larger series of aquaria may be viewed. These will be ten in number and will have a capacity of seven thousand to twenty-seven thousand gallons of water.

Passing out of the rotunda by the entrances a great corridor or gallery is reached where on one hand can be viewed the opposite side of the series of great tanks and on the other a line of tanks somewhat smaller, ranging from 750 to 1,500 gallons each in capacity. The corridor or gallery is about fifteen feet wide. The entire length of the glass fronts of the aquaria will be about 575 feet or over 3,000 square feet of surface. They will make a panorama never before seen in any exhibition, and will rival the great permanent aquariums of the world not only in size but in all other respects.

The total water capacity of the aquaria, exclusive of reservoirs, will be 18,725 cubic feet, or 140,000 gallons. This will weigh 1,192,425 pounds, or almost 600 tons. Of this amount about 40,000 gallons will be devoted to the marine exhibit. In the entire salt water circulation, including reservoirs, there will be about 80,000 gallons. The pumping and distributing plant for the marine aquaria will be constructed of vulcanite. The pumps will be in duplicate and will each have a capacity of 3,000 gallons per hour. The supply of sea water will be secured by evaporating the necessary quantity at the Woods Hall station of the United States Fish Commission to about one-fifth its bulk, thus reducing both quantity and weight for transportation about 80 per cent. The fresh water required to restore it to its proper density will be supplied from Lake Michigan. In transporting the marine fishes to Chicago from the coast there will also be an addition of probably 3,000 gallons of pure sea water to the supply on each trip.

PURIFYING FEED WATER.

Mr. Archimedes Stephenson Wall, of Chicago, writes on this subject in the *Railroad Gazette*, and the following portions are of interest to our readers generally, although the writer specifically treats of feed water for a locomotive engine. The stationary engineer may draw a broad hint from the following remarks:

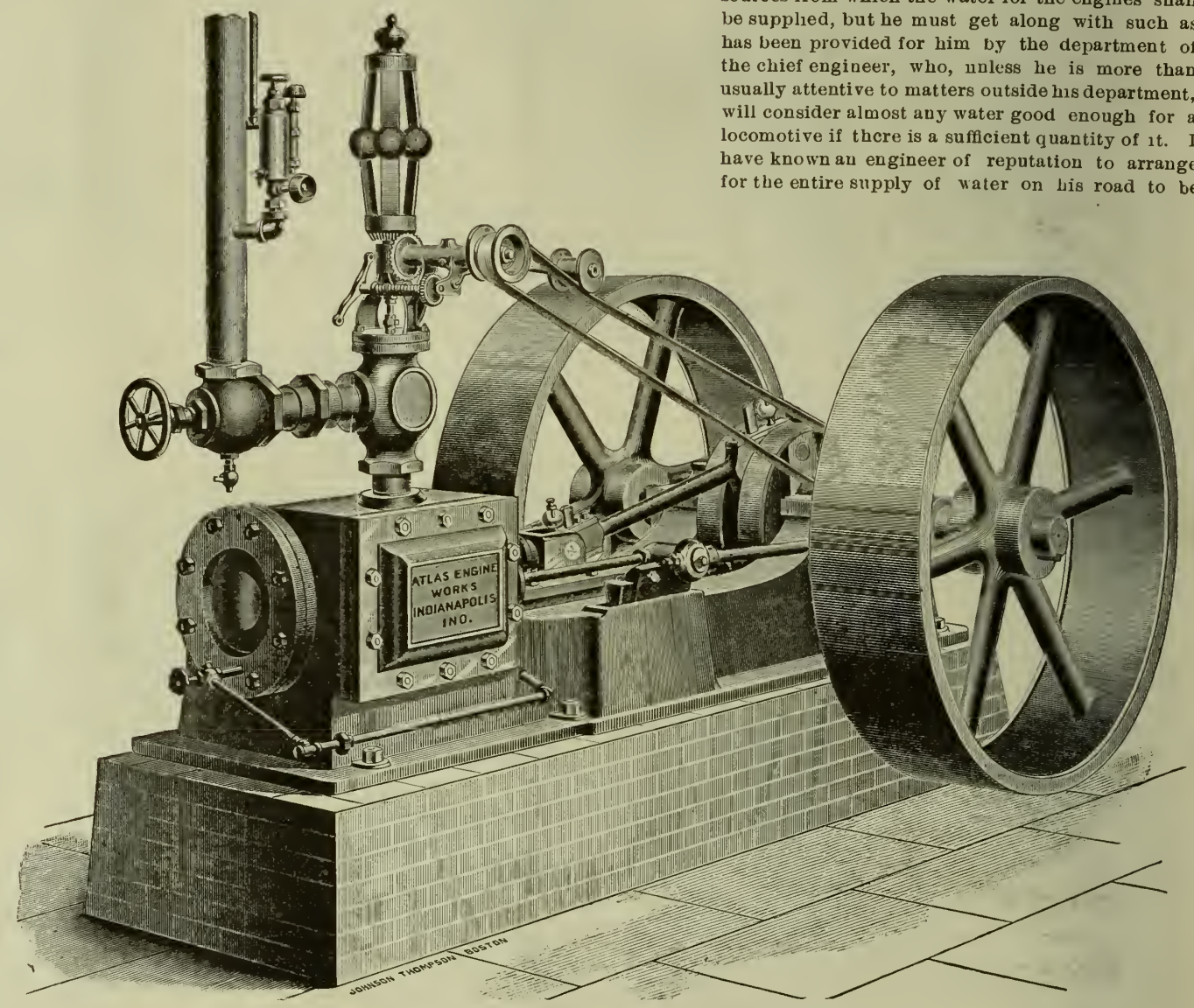
The most common substance which forms the scale in the locomotive boiler is lime in solution, and it is well known to be instantly precipitated in still water by the addition of more lime. When all has fallen to the bottom of the tank, the purified water may be drawn off, and the lime in the bottom of the tank will be available for the purification of the next charge of water. By having several tanks which can be alternately used for the precipitation of the lime and then drawn upon for the water supply, there is no labor necessary after the first charging of the tanks with a due proportion of lime, except the turning of the valves to change the flow into the empty tank, and to draw from the one which has completely settled.

Many years ago, I saw a plant upon these principles erected under the direction of Gordon H. Nott, C. E., at Adrian, Mich., which seemed to be very successful. Only two storage tanks were used, however, and the removal of the precipitated lime was sought to be in part accomplished by a rude sort of filtration, which was troublesome and cost something in labor for cleaning out; and it was evident that a better way would have been to use a greater number of tanks, or larger ones. But with this increased expense, the cost figured up only about one cent per thousand gallons treated, including interest on the cost of the plant and estimated depreciation. This experiment was on a practical scale, the tanks used being each of about 50,000 gallons capacity, equal to about two days' supply for the locomotives watering at that station in each tank; but two days is not a sufficient length of time to admit of the total subsidence of the very fine precipitate through so deep a tank as those in use there, which were about 15 or 16 ft. high. Evidently, broad, shallow reservoirs would be the best for this mode of treatment.

I made a comparative analysis of this water, which was very hard before treatment, and found that something more than 90 per cent of the lime was removed by the method of precipitation employed. Of course there can be no patent upon the method of purifying water, which has long been practiced in England, as well as on a small scale in this country, but I believe that some special form of apparatus for the convenient application of the principle has been patented. It ought, however, to be quite within the capacity of any engineer or master mechanic to construct an arrangement for this purpose which will be so elementary as to avoid any patents, and yet one which would be entirely efficient and satisfactory.

The same system is applicable to waters impregnated with other salts than those of lime; but in order to determine the proper substance to be used for precipitating them a chemical analysis will be necessary, while as to the lime a single experiment in the office with a tumbler and a pinch of lime thrown into the water will determine something although the well-known soap test is better. Or to precipitate the lime, if any, by the oxalate of ammonia, is a yet better method, because the quantity of lime contained by the water can, in this way, be accurately determined.

There is much waste of fuel incurred, in many parts of the country, simply from the use of muddy waters, for it is not usual for a settling basin or tank to be used, no matter how much sediment may be contained in the water pumped from a turbid stream. So far as I have observed, the master mechanic has nothing to do with designating the sources from which the water for the engines shall be supplied, but he must get along with such as has been provided for him by the department of the chief engineer, who, unless he is more than usually attentive to matters outside his department, will consider almost any water good enough for a locomotive if there is a sufficient quantity of it. I have known an engineer of reputation to arrange for the entire supply of water on his road to be drawn from wells in a region where every well yielded hard water, because this was cheaper in first cost than to secure pure water from running streams.



Atlas Self-Contained Throttling Engine.

HINTS TO ENGINEERS.*

BY EDWIN WOODWARD.*

The endless uses to which the steam engine is now put makes it a machine of incalculable worth, and while its worth when used with ordinary care is so great, the evils and disasters arising from the careless or more often ignorant engineer, makes it sometimes seem a questionable blessing. With every new industry requiring power, it is the ultimate duty of the engine to furnish it, and at every change of method such as we are daily, or at most yearly, meeting with, we see some new application of steam power.

This is especially true now, in the agricultural sections of the country, where the saw-mill, having

*In *Scientific Machinist.*

done its work, is replaced by the steam threshing engine, which also drives the lath and picket mill. The small semi-portable is now very available to drive the tubular well, run feed mills, churns, chopping machines, pump water, and a thousand other duties constantly rising before the face of the agriculturalist. What is more, their use is imperative, and not of volition. Need being the incentive, the engine is bought with the comforting assurance that "It will almost take care of itself. Keep plenty of water in the boiler and fire enough to keep the steam up, plenty of oil, and that is all there is of it."

A boy is given charge of it. The boiler, being new and tough, stands the abuse well, and before many weeks the boy "Knows how to run an engine as well as any one," and with this extensive practice and uniform success to recommend him, gets a more responsible position, with a steam plant, perhaps not so new, but his past luck, in the minds of the owners, insures safety; and with no new recklessness—only too much fire, too little water—an explosion is the usual result.

The loss of property is of little importance compared with the loss of life or the maiming of the innocent victims of—what? Ignorance, criminal neglect on the part of the Legislature in not giving us a law requiring evidence of the ability of the man in charge, or rapacity of the manufacturer? Let the guilty ones answer.

A person who is to take charge of a boiler should make himself familiar with all the needs or defects of it. In the first place its strength should be known, and this is best found by a force pump, warm water—cold water pressure is injurious—and a test gauge, or a steam gauge known to be correct, and the test made at least 20 per cent greater than the maximum steam pressure to be used. Knowing the boiler to be strong enough, the next step is to examine the pump, which should be in perfect working order. Having absolute evidence that the pump can supply, the business of supplying is a mere matter of routine, but a pump that will sometimes work and sometimes will not, is eligible for the most rigid and instantaneous examination. It may fail when its work is most important. Granted motion to the piston or plunger, a pump fails because it leaks. There can be no other reason, and the leak should be found and repaired. Leaky valves are common and should be ground. Leaky pistons are not so common, but sometimes occur. Repairing is the remedy. Leaky plungers are common. They need returning. The rod must be straight as far as in contact with the packing. The packing around the plungers is sometimes neglected too long, gets filled with dirt and sediment, and hardens and scores an otherwise perfect rod, and so leak.

The stuffing-box should have a generous allowance of hemp—not drawn tightly around the rod, but the box well filled, and the gland screwed down tight enough to prevent a leak. Too tight only ruins the elasticity of the packing, and causes undue friction. The suction pipe should be also looked to. It is usually the source of exasperating leaks. It is usually made up of poorly-fittted nipples, elbows, couplings, and to complete the train of evils, a globe valve without any gland, and poorly packed. Freezing weather often opens the weld at the top of the water, or in some water-pocket not properly drained. Any of these causes will destroy the efficiency of a pump, and are so known to exist—effectiveness is wanting. A leak on the delivery side of a pump is instantly visible, the water spurting at every stroke.

Leaks affect injectors the same as pumps, and in addition, the accumulation of lime and other mineral deposits in the jets stops the free flowing of the water. The heat of the steam is the usual cause of the deposits, and where this is excessive it would be well to discard the injector and feed with the pump. In many small industries it is impracticable to use a feed-water heater and purifier, but when this is not so it will be found a great aid, for one of the most important cares of an engineer is to keep the boiler clean. No scale should be permitted to collect. Mud should be allowed no place in a boiler. The writer has seen the sheets in the water leg of a locomotive type of a boiler sprung half an inch between stay bolts six inches apart, from accumulation of scale lodging and burning fast there.

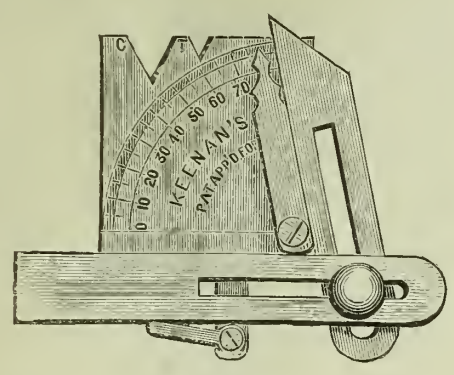
There are many compounds in the market that are recommended for dissolving scale. They should be used with care. Some are strong enough to "dissolve the boiler."

Of the many other duties relative to the care of boilers, some further reference will be made in subsequent papers, the aim being to furnish the novice with the necessary information to prevent his too ready acquaintance with the Great Mystery.

A NEW PROTRACTOR ATTACHMENT.

The accompanying illustration represents a tool of considerable interest to every mechanic.

Keenan's protractor is made of sheet steel 1-16 of an inch thick and 2 inches square, is highly finished, and can be attached to any bevel gauge, by means of an eccentric lever, which can be adjusted to any size. On one side of the protractor is a thread and centre gauge, which, with the protractor, makes three tools in one. The circular edge or arc is accurately graduated. By placing the tool on the bevel gauge, and moving the indicator to the re-



quired degrees, it is set in an instant. One of the advantages of this tool is, that it costs but a trifle compared with a bevel protractor, and can be used as a thread and centre gauge and protractor combined, where a bevel protractor can only be used as a protractor. Another advantage is, that when not in use it can be removed from the bevel-gauge in a moment.

It is to be obtained from Church & Sleight, dealers in jewelry and machinists' supplies, 109 Fulton street, New York. And they will sell a sample for $1.25, delivered by mail, to any reader of The American Engineer.

EXPLODED STORIES.

We are easily led to wonder that preachers will cling to theological ideas and theories long after they are clearly shown to be false. It is hard to part with a once cherished idol. And it is even so with regard to natural traditions, or what we are led to believe about animals, and things that are seen.

In the recently past generations travelers returned from long journeys with strange tales, not only of adventure, but of what they declared they had seen. A writer in *Forest and Stream* says: I am the owner of a natural history written by one Riley and published about the year 1789. It is a quaint old book, and its yellow leaves and odd type furnish the reader with a number of strange accounts. Among others may be found something like the following: "The digestive apparatus of the ostrich is said to be very strong indeed; that bird not only being able to digest such things as stones, bits of glass and iron, but it is even said that it makes a good meal of a bed of live coals."

We laugh at such a statement, but no doubt at the time of publication it was stated for a fact, says the Boston *Journal of Commerce*. What right have we to laugh? It is not long since almost every one believed the porcupine capable of shooting its quills like arrows, and regarded it as an animal well able to defend itself against almost any foe, instead of the quiet, inoffensive little creature, that curls itself into a ball at the first approach of an enemy, trusting solely to its spine-covered skin for protection.

Men who lived only a short time before us did not question but what the pretty, graceful swallows that skimmed so lightly o'or the blue waters in summer, buried themselves in the mud at the bottoms of our rivers and ponds when the season was over, to await the return of spring.

It has been but a short time since investigation has shown that the supposed happy family made up of the prairie dog, the burrowing owl and the rattlesnake, is not only not a happy family, but does not exist at all. Our first idea was that these three animals of such different habits lived in perfect harmony, like the so-called happy families of the modern circus; but our faith in this belief is somewhat shaken by the following, which may be found in Wood's Natural History: "According to popular belief, these three creatures live very harmoniously together; but observation has shown that the snake and the owl are interlopers, living in the burrow because the poor owner cannot turn them out, and finding an easy subsistence off the young prairie dogs."

We were satisfied with this for a time, but judge the astonishment created when Elliott Cones, in one of his latest writings, makes the following statement in speaking of the burrowing owl: "I have found colonies in Kansas and other States, in all cases occupying the deserted burrows of the quadrupeds, not living in common with them as usually supposed."

Naturalists are now telling us, continues our Boston contemporary, that the opossum does not play 'possum, but is merely paralyzed with fear for the time being; articles are published every day in our ornithological papers and magazines which go to prove that owls can see equally as well by day as by night. It is still an undecided question whether snakes "charm" their prey or not. In the western backwoods these old stories are still believed in; the ignorant classes cling with fondness to them and will not learn anything different, and down in our own hearts do we not all cling to them, more or less? Do we not hate to give them up, and is it not with a little regret that we are forced to acknowledge that the porcupine does not shoot his quils, that the bird of paradise really has feet and legs, and that our national bird, the white-headed eagle, is far from the noble bird we once thought him to be.

ABOUT AMBER.

The masses of amber thrown by every storm on the strands of Jutland and Scania, although neglected by the first settlers upon them, attracted the eager attention of their sepulchre-building successors, says a writer in the *Edinburgh Review*. The submarine product cast at their feet by the waves served not only for the adornment of their persons, living and dead, but for their protection against supposed malefic influences, and, gradually becoming known to distant peoples, was bartered, in the growing trade centers of the south, for objects fraught with the significance of a new era.

The traffic assumed large proportions. To the diffusion of the fossil gum of Jutland from Liguria to Thrace corresponds an equally surprising plenty of bronze and gold in Scandinavia, where, too, finds of wrought amber and of the objects purchased with it suggests a reciprocal relation, scarcity of the first attending on plentifulness of the second. Not even in those remote times was it possible at once to have a cake and to eat it. About the sixth century B. C., the Etruscans entered the market. Amber occurs in the oldest tombs at Cervetri, and its exchange for bronze wares explains the stamp of Etruscan design impressed upon many objects now in the Copenhagen Museum. Although the materials for their construction were imported, the discovery of the moulds in which they were cast proves conclusively the weapons and implements of the bronze age in the north have been of home manufacture. Their remarkable beauty and elaboration tell of an advance in taste ensuing upon the development of commerce they sprang from, while the system of ornament adopted in them betrays an oriental origin. Its elements were probably rooted in religious symbolism—fire, for example, being denoted by the zig-zag; the sun, by the double spiral characteristic of Danish bronze work, although found as well on the pottery of the beehive tombs of Mycenæ.

Has electricity much, or anything, to do with boiler explosions?

The American Engineer.

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TO WHOM IT MAY CONCERN.

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JEFFERSON YOUNG, JR.
Supreme Chief Engineer A. O. of S. E.

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CONTENTS OF THIS NUMBER.

HARRY HOHN is now well in sight of a fund that will afford him a fresh start in life. The Philadelphia delegation did well in taking him to the Syracuse convention. His very presence was a great sermon on the necessity of brotherly help. He will soon be set up in business; and it may be that Bro. Harry Hohn may yet become a merchant prince in the new line that is about to open for him.

EXHIBITORS at the Syracuse Engineers' Fair have not been fully reported, it seems. As we go to press our attention is called to the fact the Stewart Heater Co., and R. Brandt (packing) made good exhibits, as well as those mentioned in our last issue. In our next number we hope to give a complete list of exhibitors and exhibits.

SUPREME Council meetings afford opportunities for old friendships to be renewed. Thus Bro. H. K. Stroud, Deputy Supreme Chief Engineer of Minnesota, was delighted to meet Bro. Milo Carrier, of St. Paul, at Syracuse. Bro. Stroud was also extremely pleased to meet Bro. Callison as well as other steamship acquaintances of Auld Lang Syne; and the landsmen could not separate them. The engineers of the east were very glad to see the delegate from beyond the big river, and the prompt Deputy Supreme Chief of Nebraska, was glad to be on his way to the coast to smell salt water again.

THANKS FOR CONVENTION DONATIONS.

Bro. Geo. H. Kellogg, the able Secretary of the Committee of Arrangements, through whose efforts the officers and delegates of the Supreme Council, A. O. S. E., were so admirably entertained while attending their sixth Convention at Syracuse the past week, writes that the Committee of Arrangements, of John E. Sweet Council, No. 6, N. Y., wish to thank the following firms, etc., for donations to assist them in entertaining the officers and delegates. The names appear in the order the contributions were received:—

Stilwell & Bierce, Dayton, O	$ 5.00
Albany Steam Trap Co., Albany, N. Y.	10.00
Revere Rubber Co., Buffalo, N. Y.	10.00
Bradley & Co., Syracuse, N. Y.	10.00
Syracuse Chilled Plow Works	10.00
Frank Howlett, agent for Boston Belting Co., Syracuse, N. Y.	5.00
Syracuse Consolidated St. R. R. Co., tickets	5.00
Capt. M. P. Brown, Steamer "N. B. Kirk"	5.00
Chapman Valve M'fg. Co., Indian Orchard, Mass	5.00
Jenkins Brothers, New York	5.00
Kirby & Miller, Auburn, N. Y.	5.00
Rudolph Brandt, New York	5.00
Jefferson Young, Jr., agent for Wheeler & Tappan Co., Chicago	25.00
Phœnix Foundry, Syracuse, N. Y.	10.00

The kindness of the above contributors and the goodness of those who sent their goods to the great exhibition at the Alhambra shall never be forgotten, says Bro. Kellogg. And all the A. O. S. E. men throughout the country will say "Amen."

Since the above was written, we have received the further information that the Engineers' Fair was a success, financially, as well as otherwise.

"After paying all bills we had a balance of $10," says our correspondent, "which, by the unanimous vote of the John E. Sweet Council, was given to Bro. Kellogg, the Secretary of the Committee of Arrangements, but Bro. Kellogg donated it to the Harry Hohn Fund.

"The people of Syracuse seemed astonished as they gazed upon the delegates when they assembled, at corner of Genesee and Salina streets, to attend church. 'Why, those fellows do not look like engineers, they look more like gentlemen,' said one 'they look like men of leisure,' said another. 'Yes, they are an intelligent lot of people, certainly,' responded a third.

"Truly they were gentlemen, every one of them. And the Syracusians feel proud in being honored by their visit. The boys of No. 6 (John E. Sweet Council), most surely, will never forget 'the good old time' which they enjoyed during the convention just closed. The face of every delegate will remain in the memory for many years to come, especially that of Bro. Lightfoot, of Philadelphia. When the Council and delegates and friends went to Maple Bay for an outing and a banquet, after their hard work the previous day and night, Bro. Lightfoot showed himself to be light of foot indeed, by the way he dashed into the dancing pavilion, as soon as the party landed from the steamer. Many an eye was dimmed with tears, and many a side ached with mirth when Bro. Lightfoot dashed off in a dizzy waltz to the soul-stirring strains of Annie Rooney.

"The last of the manufacturers to take his departure was Robert Forsythe, secretary and treasurer of the Wheeler & Tappan Co. He left Friday night. Robert sent up word that he wanted to shake with the boys before leaving, whereupon Chief Engineer Halbritter adjourned the John Sweet Council, which was then in session, and 'Bob' was escorted into the council chamber, where he made a farewell speach, emphasizing it with a box of cigars. The boys will stick to Bob; you can just bet on that. Look out for them when they come to Chicago."

The Committee of Arrangements (C. A. Halbritter, chairman; Geo. H. Kellogg, sec.; J. H. Benedict, treas.; W. A. Gleave, and G. W. Batheswell) acknowledge receipt of a standard thermometer from "that company of Peabody, Mass." They express the hope that the Committee of Arrangements for '93 will meet with great success.

The World's Fair Convention will probably see the A. O. S. E. doubled in membership.

ABSENT IN THE BODY, ETC.

The following letters speak for themselves:

HOUSE OF REPRESENTATIVES.
SYRACUSE, N. Y., June 19, 1891.

MR. JEFFERSON YOUNG, JR.,
S. C. E., American Order of Steam Engineers.

DEAR SIR:—Replying to yours of the 13th inst., I would say I regret exceedingly, that a previous engagement will prevent my acceptance of your kind invitation to be with you at the opening of your Fair, July 13th. I do not expect to be in town.

Yours truly, J. J. BELDEN.

NATIONAL MARINE ENGINEERS' BENEFICIAL ASSO.
DETROIT, Mich., July 10, 1891.

JEFFERSON YOUNG, JR., ESQ.
S. C. E., A. O. of S. E., Syracuse, N. Y.

DEAR SIR & BRO:—I regret very much my inability to be present at your reception on the 13th inst. my official duties demanding my presence in another section at that time.

Please accept my best wishes for the success of your meeting.

Thanking you for your kind invitation,
I am, yours fraternally,
JOHN H. GALWEY, N. P., M. E. B. H.

STATE OF NEW YORK, EXECUTIVE CHAMBER.
ALBANY, July 6, 1891.

JEFFERSON YOUNG, JR., ESQ.,
Supreme Chief Engineer, American Order of S. E.

DEAR SIR:—Governor Hill desires me to acknowledge your letter of 4th instant, inviting him to be present at the mass meeting of engineers and mechanics in Syracuse on July 13th during the annual session of the Supreme Council, American Order of Steam Engineers.

The Governor greatly regrets that his engagements for that day deprive him of the pleasure of accepting your kind invitation. Expressing his appreciation of your courtesy, I remain, Yours very respectfully, I. S. WILLIAMS, Private Secretary.

SIBLEY COLLEGE UNIVERSITY.
ITHICA, N. Y., July 19, 1891.

MR. JEFFERSON YOUNG, JR.,
Syracuse, N. Y.

SIR:—Referring to the proposed meeting of Monday, I am very sorry to be compelled to say that I am unexpectedly called upon to go East that day to meet an important business engagement, and am thus disappointed in my hope of meeting you at Syracuse on that day.

I am very sorry, indeed, but hope that I may enjoy better fortune at some future time. Yours very truly, R. H. THURSTON.

P. M. Arthur, Chief of the Brotherhood of Locomotive Engineers, also sent his regrets for inability to be present at the A. O. S. E. convention. His letter has been mislaid, unfortunately. He spoke very highly of the Order of which Mr. Jefferson Young, Jr., is chief.

Lieutenant Governor Edward F. Jones, of Binghampton, N. Y., had also sent a letter saying he was afraid he would not be able to be present. But where there's a will there's a way, and he managed to avail himself of the opportunity to meet the American Order of Steam Engineers in full blast.

ANOTHER BOILER EXPLOSION.

A despatch from Stanton, Mich., dated the 20th inst. (Monday) says:

A boiler explosion, in which two persons were killed instantly and one was injured so that he died shortly afterward and several others were badly cut and bruised, occurred in Perkin Brothers' saw-mill at Lakeview, this county, late this afternoon. The list of the killed is as follows: R. C. Gregory, Eddie Gregory, his son, aged 13 years, and E. G. Peters. Gregory, who was the fireman, was talking with his son near the door of the boiler-room, when the explosion occurred, and both were horribly mangled and instantly killed. E. G. Peters, who was one of the proprietors of the mill, was blown some distance and so fearfully cut and bruised that he died within an hour. Several of the other employes in the mill escaped with scalp wounds and bruises. The dome of the boiler and other large pieces of iron were blown from forty to fifty rods. The cause of the explosion is supposed to have been lack of water.

ELECTRICITY.

VI—THE ELECTRIC MOTOR.

A so-called "expert" electrician would probably lead up to the dynamo before treating of the electric motor. But we take the motor first—for two reasons: 1, because the motor was in existence, and in operation, before the main principle of the dynamo was discovered, and long before the word itself was coined out of the Greek term dynamis (force); 2, because to run an electric motor is a far simpler task than to operate a dynamo, and a motor man learns his business much quicker and easier than the dynamo tender is educated to the requirements of his position. Then, to make an electrician out of a practical engineer, the easiest way for him to proceed is by way of the electric motor. Let him have charge of a motor, until he gets acquainted therewith and understands it. Then he can undertake the care of the greater and more important machine, the dynamo, with more confidence a great deal. That is the common sense way, and the plan in keeping with the methods adopted in schools and colleges, namely learning the easiest lesson first.

Numerous machines were constructed to make use of electricity to develop power after the discovery of electro-magnetic action by Oersted in 1819. "The principle of construction in all these machines," as a recent book states, "consisted in energizing electro-magnets by a battery current, and by their attraction and repulsion producing mechanical action, either rotary or oscillating." The most noted makes of those motors are mentioned on pages 191 and 192 of the Elements of Dynamic Electricity and Magnetism (by Atkinson), wherein it is said that "from 1830 to 1873 various motors of the above kinds were constructed, and attempts made to operate machinery and propel boats and cars with them; one of the most noted of these experiments having been made by Jacobi with his motor at St. Petersburg in 1838, with which he propelled a boat on the Neva, carrying 14 passengers, at the rate of three miles an hour, employing, first a Daniell battery of 320 cells, and subsequently a Grove battery of 138 cells."

The motor in that period was not working well, because sufficient current, to make it powerful enough, could not be obtained.

The cylinder electric machine was the best mode to obtain electricity "in large quantities" for a long time. It was considered much better than "the plate machine," in many respects. It consisted of a hollow cylinder of glass (the substance rubbed), supported on brass bearings, which revolved in upright pieces of wood attached to a rectangular base; a cushion of leather stuffed with horse hair (the rubber), fixed to a pillar of glass furnished with a screw to regulate the pressure on the cylinder; and a cylinder of metal or wood covered with tin-foil (the conductor or reservoir to hold the electricity), mounted on a glass stand, and terminated on one side by a series of points to draw the electricity from the glass, and on the other side by a brass ball. In order to keep the rubber and conductor warm and dry, Ronalds (in 1823) placed them on hollow glass tubes with lamps burning underneath. A more uniform warmth was obtained by placing a piece of metal about 6 inches square, heated by an argand lamp, beneath the cylinder. A flap of oiled silk was attached to the rubber to prevent the dissipation of the electricity. And the surface of the leather cushion was smeared with metallic amalgams to improve the excitement.

But electricity for motor purposes was obtained, as already intimated, from chemical action. Electricity obtained from a chemical battery is the best for telegraphic and numerous other purposes. But for developing power it was a failure, except as an interesting phenomenon more to satisfy curiosity than for useful work.

Electro-magnetic machines were in time developed, Siemens and Wilde taking the lead. And Siemens and Wheatstone produced the first edition, so to speak, of the modern dynamo. The word "dynamo" was first used, at least as a name for an electric machine, by Dr. Werner Siemens in a communication to the Berlin Academy, dated January 17, 1867. And dynamo is ever since the common name for the machine which generates the electric current in really very "large quantities," or to a powerful extent.

We will say no more about the dynamo, at present, except just mention that the steam engine drives the armature of the dynamo, which thus (and on account of its environments) generates the electricity. From the dynamo the current is conducted into electric motors, far or near, stationary or moving, and by each motor converted into mechanical energy wherever wanted.

When it was accidentally discovered, at the Vienna Exposition of 1873, that a Gramme electric machine made another Gramme machine "run," when the two were connected by wires, a new era in applied electricity commenced. The reversibility of electrical energy had been known theoretically before. But at the time mentioned it was practically demonstrated. And soon afterwards, electricians ventured to set up a central electrical power house, where powerful dynamos (by power derived from steam engines) generated powerful electric current, which current they conveyed by wires to motors on street cars. It was at first "a venture." Theoretically the electricians knew what they were doing, but they were influenced by "honest doubt" to such an extent as to place two motors on a car, instead of a larger *one*, thinking that if one of a pair failed the other might "pan out" all right.

Stationary motors have also become very numerous. They are used advantageously where mechanical power is necessary. A boiler recently exploded in a large printing office, in Chicago, destroying the whole power plant, killing several persons and injuring others. This occurred on a Saturday afternoon. On the following Monday morning an electric motor was installed, connected to the Edison main electric circuit in the locality, and the work of the printing office proceeded "as if nothing had happened," as it were.

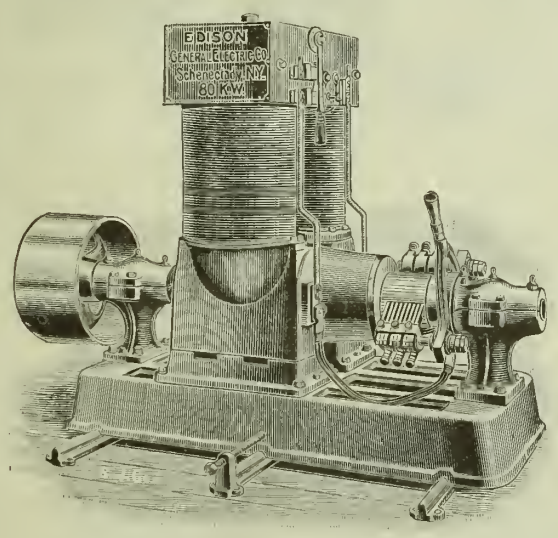


FIG. 4. EDISON 80 H. P. STATIONARY MOTOR.

It would have taken several days, if not weeks, to rebuild and equip the power plant on the old style. The advantages of an electric motor are numerous, and the benefits very great. And steam boilers and engines are bound to become few and far between, in our cities. The steam engines and boilers will still be there, but they will be concentrated. Instead of being scattered, as hitherto, they will be all in one place (in a district) and their power will be utilized by means of the electric motor. The condition of many a hard-working engineer will thus be improved. Instead of being half-killed in a hot engine room, he will merely have to keep an eye on the electric motor, and see that the connections and the machinery are working all right.

The engraving on this page (Fig. 4) affords a view of the Edison new style 80-horse power stationary motor. This neat little machine is less than 83 inches high, and will occupy a floor space of only 105 1-16 inches by 68 3-8 inches. It is heavier than it looks, however, and turns the scale at about 16,200 pounds. The pulley is 26 inches in diameter, with a 16-inch face, and 3¼ inch bore. Its rated speed, with a current of 110 volts, is 530 revolutions per minute; the belt speed per minute being 3,328. This will develop all the power that may be required up to 80 horse power (and over). It is adapted for all kinds of work where constant speed is required with an intermittent load, such as in the operation of lathes, circular saws, printing presses, etc. It is automatic in regulation, due wholly to a particular method of winding, and not to mechanical governors.

The figure and letters 80 K. W. will be observed on the top part of the cut. A kilo-watt (K. W.), one thousand watts, is equivalent to one electrical horse power. It should be noted here that there is a considerable difference between a mechanical and an electrical horse power. The latter, as already stated, is equivalent to 1,000 watts, while the mechanical horse power is equivalent to about 746 watts, being very nearly 25 per cent less. This difference has been made, probably, to cover to some extent the loss of energy in the conversion of power from the steam engine to the dynamo, from which the motor receives its current. Thus an engine of 80 h.p. (59,680 watts) corresponds approximately to a dynamo of 80 h.p. (80,000 watts).

ELECTRICAL UNITS.

A watt (so called after the famous engineer James Watt) is the electrical unit of power, adopted in response to the proposal of Dr. C. W. Siemens, and is equivalent to the force conveyed by a current of one ampere through a difference of potential of one volt, or a resistance of one ohm. In other words, it is the amount of work necessary to raise one coulomb to one volt.

A coulomb (named after the French electrician Coulomb) is the quantity of electricity conveyed in one second by the current produced by an electromotive force of one volt, acting in a circuit having a resistance of one ohm, or the quantity produced by one ampere in one second. It was formerly called a weber. In further explanation of this electrical unit, a modern author says: "A ten-ampere current flowing for one second, or a one-ampere current flowing for ten seconds represents ten coulombs. And since there are 3,600 seconds in an hour, 3,600 coulombs equal one ampere-hour."

The principal units, however, are the volt, the ampere, and the ohm, adopted in honor of Volta, Ampere, and Ohm. If we compare the flow of electricity on the outside of a conductor to the flow of water through a pipe, which is a popular analogy, we may say that the amperage of the electric current is equivalent to the flow or quantity (volume) of the water, while the voltage or strength of the current resembles the force or head of the water; and the resistance, expressed in ohms, which the wire gives to the current, corresponds (more or less) to the friction which the water has to overcome in the pipe. And to ascertain the power of an electric current, we have to multiply the amperes (quantity) by the volts (force) divided by the ohms (resistance).

One ampere is so much electricity as will have the force of one volt operating in a circuit which gives a resistance of one ohm.

One volt is the electro-motive-force (E. M. F.) which produces a current of one ampere in a circuit having a resistance of one ohm. One who ought to know states that the standard volt of to-day is about ten per cent less than the electro-motive-force of a Daniell's sulphate of copper cell.

One ohm is the degree of resistance in a circuit, or conductor (wire), in which a potential difference of one volt produces a current of one ampere. The word potential, in this connection, means the energy that moves a volume of one ampere in spite of the one-ohm resistance.

There has been more trouble concerning the ohm than any other electrical unit. The resistance was formerly expressed by a given length of a wire of a given gauge, which worked very confusingly. The ohm, as generally adopted to-day, is equal to the resistance of a column of pure mercury one square millimeter in section and 106 centimeters in length at a temperature of zero Centigrade. This value was decided upon by the International Congress of Electricians at Paris, in 1884, and is recognized as the "legal" ohm. Previous to that, the British Association unit of resistance, or B. A. ohm, which is equal to 1.0112 legal ohms, had been in general use.

"Ohm's law" is an expression often met with in electrical literature, and might as well be mentioned here. It is the statement of the fact, by the Ger-

man electrician G. S. Ohm, that the strength or intensity of an electric current is directly proportional to the electro-motive-force, and inversely proportional to the resistance of the circuit; or, in other words, the power of the current varies exactly as the electro-motive-force (voltage), by which the current is driven, varies, subject to the variation caused by difference in the resistance, which is also exactly proportional the other way.

Other units, of which it would be well for an engineer to know, are the dyne and the erg. The dyne, which is from a Greek word meaning *force*, and no doubt suggested the name dynamo, is the unit of force in the Centimeter-Gram-Second (C. G. S.) system of physical units, namely the force which acting on a gram for a second, generates a velocity of a centimeter per second.

The erg is the unit of *work* or energy in the C. G. S. system and it is the amount of work done by a dyne (of force) working through a distance of one centimeter. In other words it is the amount of energy expended in moving a body one centimeter against a force of one dyne. One foot pound is equal to 13,560,000 ergs. And when we bear in mind that a mechanical horse power is equivalent to a lift of 33,000 pounds at the rate of one foot per minute, it becomes evident that the erg is but a very small portion of a horse power. And for practical purposes, the horse power is the most convenient for an engineer to base his calculations upon. This is the unit he has been accustomed to with his engine, and the same horse power, with about 33 per cent added thereto, gives him the horse power unit for calculating the power of the electric motor.

parts. All these machines are standardized, and parts made interchangeable. To know the name of each part will be convenient even in ordering duplicates at any time. And remembering the names of the parts will clear the way very much when we proceed to explain the construction of a dynamo. For the parts of the dynamo are similar to a great extent to those of the motor. The dynamo is generally much larger and has to supply current to a number of motors. Then the motor is built more compactly, as it is more exposed to dust and rough usage. Both machines, however, have to be properly installed and cared for, but there is nothing difficult about either; a clear head and common sense, together with a little mechanical knowledge being the necessary stock in trade of a motor man.

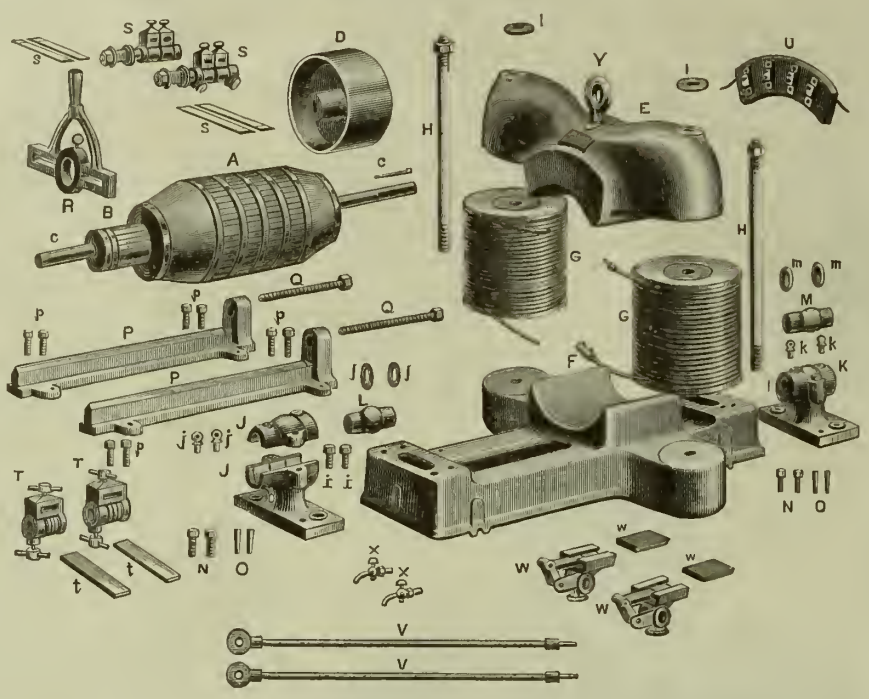


Fig. 5.—Parts of the Edison Old Style Stationary Motor.

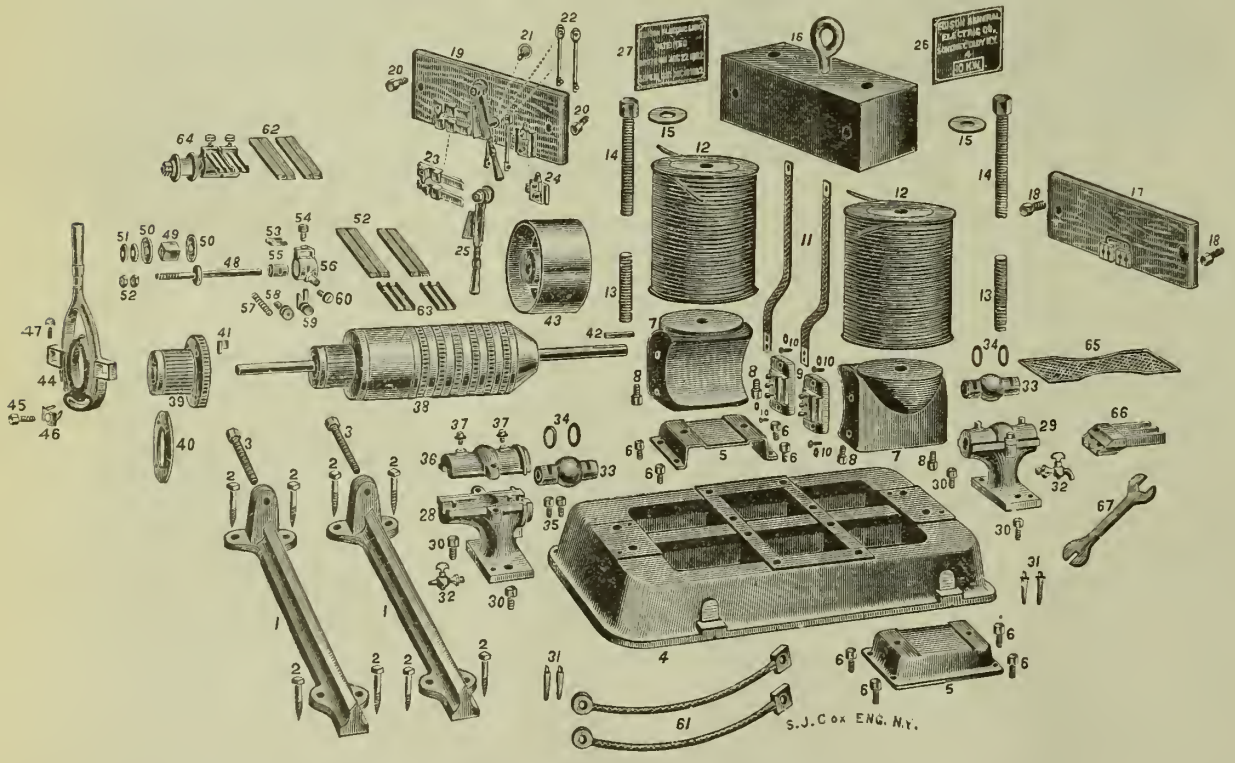


Fig. 6.—Parts of the Edison Standard Motor.

The Edison Motor Dissected.

Although the fellow who cut up the organ to see where the music came from did not gain much by his investigation, it is a fact that the famous George Stephenson gained an insight into the construction of his father's family time piece when he pulled the clock to pieces, and endeavored to put it together again.

We shall not find the electricity by examining the electric motor piece by piece, but it will be very convenient to know the names of the different

In the cuts showing the parts, Figs. 5 and 6, we show the old and the present style of the Edison motor. Fig. 6 (new style) shows the parts of the standard motor represented by Fig. 4, only the parts are those of a ten-horse-power size.

It will be noticed that some of the parts differ very much in the old and new styles. The old bed plate (F) bears hardly a resemblance to the new one (4). The old armature (A) differs from the new (38). Comparisons of other parts may be readily made.

Names of Parts (Old Motor.)

A Armature. B Commutator. C Shaft. c Pulley Key. D Pulley. E Keeper. F Bed Plate. G Field Coils. H Keeper Bolts. I Washer. i Pillow Block Bolts. J & K Pillow Blocks. j & k Oil Hole Plugs. L & M Pillow Block Bearing. l & m Rings. N Cap Screws. O Dowell Pins. P Rails. p Lag Screws. Q Rail Bolts. R Rocker Arm. S Brush Holders for small sizes of motors. s Brushes for small sizes of motors. T Brush Holders for large sizes of motors. t Brushes for large sizes of motors. U Connecting Board. V Brush Holder Cables. W Carbon Brush Holders. w Carbon Brushes. X Pet Cocks.. Y Eye Bolt.

List of Parts of Edison Standard Motor.

No. 1. Rails.
No. 2. Lag screws for rails.
No. 3. Adjusting screws for rail.
No. 4. Bed plate.
No. 5. Zinc bases for fields.
No. 6. Bolts for securing same to bed plate.
No. 7. Pole Pieces.
No. 8. Bolts for securing same to zinc bases.
No. 9. Lower terminals for motor leads secured to front side of pole pieces.
No. 10. Bolts for securing same to pole pieces.
No. 11. Motor leads from lower terminals to head board.
No. 12. Field coils and cores.
No. 13. Lower screws for attaching field cores to pole pieces.
No. 14. Bolts for attaching keeper to pole pieces.
No. 15. Washers for same.
No. 16. Keeper.
No. 17. Back-board and field coil terminal blocks.
No. 18. Bolts for attaching same to keeper.
No. 19. Motor head-board.
No. 20. Bolts for attaching same to front side of keeper.
No. 21. Stop-stud for the motor head-board switch.
No. 22. Motor head-board field terminals.
No. 23. Left-hand motor lead terminal and switch tongue complete.
No. 24. Right-hand motor lead terminal for head-board.
No. 25. Motor head-board switch bar, including tongue, stud and nut complete.
No. 26. Data Plate.
No. 27. Name plate.
No. 28. Lower half of self-oiling bearing, commutator end.
No. 29. Lower and upper half of self-oiling bearing, pulley end.
No. 30. Bolts for securing self-oiling bearing to base plate, either pulley or commutator end.
No. 31. Dowell pins for same.
No. 32. Drip-cock for self-oiling bearings, either pulley or commutator end.
No. 33. Shell for self-oiling bearings, either pulley or commutator end.
No. 34. Ring for self-oiling bearings, either pulley or commutator end.
No. 35. Bolts for securing upper half to lower half of self-oiling bearings, either pulley or commutator end.
No. 36. Upper half of self-oiling bearings, commutator end.
No. 37. Brass plugs for closing oil-holes of upper half of self-oiling bearings, either pulley or commutator end.
No. 38. Armature complete.
No. 39. Commutator complete.
No. 40. Fibre ring for commutator.
No. 41. Brass terminal for end of armature coils.
No. 42. Armature pulley key.
No. 43. Armature pulley.
No. 44. Brush yoke.
No. 45. Bolt for securing same.
No. 46. Spring washer for use with No. 45, for adjusting tension on yoke.
No. 47. Thumb-screw for yoke to secure same to prevent lateral motion.
No. 48. Brush holder stud.
No. 49. Insulating block for brush holder.
No. 50. Insulating rings for brush holder.
No. 51. Brass washers for brush holder terminals.
No. 52. Brass nuts for brush holder studs.
No. 53. Brass pressure trough for brush holder.
No. 54. Bolt for securing brushes in brush holder.
No. 55. Internal rigid cylinder for brush holder.
No. 56. External movable cylinder for brush holder.
No. 57. Spring for adjusting tension between internal and external cylinder of brush holder.

No. 58. Screw for adjusting tension of spring.
No. 59. Screw cam for holding brush out of contact with commutator.
No. 60. Bolt for securing internal cylinder rigidly upon brush holder stud.
No. 61. Brush holder cables.
No. 62. Motor brushes, either side.
No. 63. Brush holder troughs.
No. 64. Brush holder complete.
No. 65. Wire screen for use between field coils protecting armature.
No. 66. Brush filing jig.
No. 67. Motor wrench.

THE SUPREME COUNCIL MEETING.

In the hurry of setting up our report of the first day's proceedings of the Syracuse Convention, in last week's issue, the name of H. G. Connors appears as a delegate from New Jersey. He is the Grand Chief Engineer of Pennsylvania, and his name should have appeared with the Pennsylvania delegation.

After the Supreme Chief Engineer, Jefferson Young, Jr., had taken the chair, and the various officers being in their proper stations, the Supreme Council proceedings were opened by the singing of the national anthem, "My Country,'Tis of Thee," and prayer by Acting Chaplain, C. M. Baker, Grand Chief of Michigan.

The Committee on Credentials was next appointed by the Chair. The Recording Engineer not being present on Monday morning, the meeting adjourned to Tuesday morning, July 14, at 8 a. m. Then the Committee on Credentials presented their report, which certified that the delegates from Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Ohio, Michigan, Missouri, Minnesota, and Nebraska were entitled to seats on the floor. The report was accepted. The minutes of the fifth annual meeting (at Philadelphia, last year) were then read, which occupied an hour and forty minutes. The minutes, as read, were accepted.

The Supreme Treasurer reported the per capita tax fully paid, and in the treasury.

Reports of officers and standing committees were next received, and accepted. The committees were then discharged.

The following committees were then appointed, by the Chair; namely the Committee on Ritual, Mutual Benefit, Rules and Good of the Order, Financial and Auditing, Ways and Means, and Law and Constitution.

The Supreme Council, at this point, adjourned to meet at 1 p. m. the same day (Tuesday). The first business in order, after adjournment, were the reports of Committees, which were received and approved. The Report of the Supreme Corresponding Engineer, and also that of the Supreme Treasurer Engineer were also read, received and approved. The Council then proceeded to business, in regular form, as laid down in the Constitution, in the course of which the amendments to the Constitution were reached. These amendments consisted of some 125 different articles and sections, many of which were passed on first reading, while others were the subjects of warm discussions, one article alone occupying the Council two hours and forty minutes. The day was very warm and with two or three exceptions the members divested themselves of coats and vests to do battle in the interest of the Order.

At 6 p. m., while the amendments were under consideration there was an adjournment for an hour, for supper. On reassembling, at 7 o'clock, the Supreme Chief and nearly all the members were in their places sharp, and forthwith proceeded to consider the portions of the amendments that had not been disposed of. The Council continued hard at work, on this business, until 12:30 a. m., when a ten minutes' recess was taken to partake of a lunch provided by Merrick Cowles, of Chicago, which was "ably seconded" by cooling drinks supplied by Deputy Supreme Chief, H. K. Stroud, of Minnesota. All were delighted with, and refreshed by the lunch and cooling drinks, and returned to their work at which they continued until 2:30 on Wednesday morning, by which time the work on the amendments had nearly been completed. But, by this time, the members were so tired, after such a long session (19 hours, minus the two recesses), that they agreed to adjourn for four and one-half hours. They met again at 7:30 a. m. July 15, and finished the work of amending the Constitution.

Prior to the closing of that session, a very agreeable plan was introduced by which the per capita tax will be abolished, and which created great interest and enthusiasm on the part of all present. And it was accepted by a rising vote.

Noon (of Wednesday) now having arrived, the Council adjourned to meet at 7:30 July 16. Wednesday afternoon and evening were given up to pleasure and recreation. The members with their ladies and friends convened at the Empire House, at 2 o'clock. Thence they took cars, under the guidance of the John E. Sweet Council, to the steam boat which conveyed them to Maple Bay, on Lake Onondaga, a distance of some six miles, and a most delightful resort, one of several on this beautiful lake. The members amused themselves by dancing, nine-pins, etc., until 5:30 when they all assembled at the Maple Bay Hotel and did justice to a most elegant banquet which had been prepared by the proprietor, Mr. Baker.

The return from Bay View was by moonlight, and was very thoroughly appreciated. It was half past ten when the party reached Syracuse.

The Council met again at 7:30 a. m., July 16, (Thursday). Supreme Chief Jefferson Young was promptly in the Chair. Action on the report of the Committee on Mutual Benefit having been deferred was at this juncture taken up, when it was resolved that the Mutual Benefit Fund be abolished, and that the Mutual Benefit Fund be made co-existent with the membership of the Order, that is making every member a beneficiary; and that hereafter every man taken into this Order will be required to pass a medical examination, and that each member be furnished with a certificate of insurance to the amount of $2,000, payable at death or total disability. A very animated discussion took place as to what constituted "total disability." And it was finally decided that the loss of two legs, or of two arms, or of both eyes, or of paralysis (so as to be unable to use one's limbs) should be considered as total disability.

Another very important resolution was passed, one of great interest, not only to this Order, but to all steam engineers generally, namely to build

A HOME FOR DISABLED ENGINEERS.

The council authorized the Board of Trustees, who were appointed a Committee to take charge of the matter, to take such action, as they might deem proper, as soon as possible, to bring the matter before the attention of business men, and to select a sight for the Home.

At a meeting of the Board of Trustees, action was taken, and sub-committees appointed to carry forward the work of collecting a fund, etc.

Rule 14 being in order, the Council proceeded to elect officers for the ensuing term of two years. The Supreme Chief Engineer, and the Supreme First Assistant Engineer, having been elected at the Philadelphia meeting (last year) for a term of three years, were not considered; and they, with the following newly elected officers, will continue in office until the next Supreme Council meeting, which will be held in Chicago in 1893. The following were elected:

Charles E. Jacks, Boston, Mass.,—Supreme Recording Engineer.

Frank S. Neal, Cincinnati, O., —Supreme Corresponding Engineer.

James E. Deas, Bridgeport, Conn., — Supreme Treasurer, Engineer.

W. B. Carr, Boston, Mass.,—Supreme Chaplain.

J. J. Wilson, Wahoo, Neb.,— Supreme Senior Master Mechanic.

C. M. Baker, Grand Rapids, Mich.,—Junior Master Mechanic.

H. K. Stroud, Hastings, Minn.,—Supreme Inside Sentinel.

L. Calloway, Philadelphia, Pa.,—Supreme Outside Sentinel.

Supreme Board of Trustees.

The Board of Trustees having been enlarged from five to seven, and the term of three of them having expired, necessitated the election of five members, the following being chosen, namely: B. Born, Boston, Mass., and H. G. Connor, Philadelphia, Pa., for a term of six years (ending 1897); H. M. West, Boston, Mass., and A. W. Southwell, Cleveland, O., for a term of four years (ending 1895); and Thomas M. Thompson, Detroit, Mich., for a term of two years ending 1893). The continuing members are W. E. Jones, New York, (term ending 1893), and Frank Weidner, Philadelphia. (term ending 1895.)

Supreme Court of the Order.

Chief Judge:—John W. Teller, Utica, N. Y.

Associate Judges:—Chas. E. Jacks. Boston, Mass.; H. M. Callison, Syracuse, N. Y.; Eben B. Hill, St. Louis, Mo.; John Dooner, Chicago, Ill.; John Oswald, San Francisco, Cal.; and Henry Coates, Portland, Ore.

Secretary-Treasurer Mutual Benefit:—Chas. E. Jacks, Boston, Mass.

After these elections the Council adjourned until evening.

In the afternoon the members gathered at Klein hall (where the Council meetings were all held), where they took carriages and proceeded 211 East Castle Street, the residence of the Supreme Chief. A pleasant half hour was spent here, where the visitors partook of ice cream, etc. Thence they went to the Alhambra hall where they were photographed in a group at the expense of the Wheeler & Tappan Company. From there they went to the Straight Line Engine Works, and their visit there was very much enjoyed, especially the exhibition given by Prof. Sweet which consisted of the taking of indicator cards while the engine was under 60 lbs. pressure. Cuts of these cards will be given in a subsequent issue. The famous Bradley cushioned hammer works were next visited. The Bradley Company also manufacture forges, carriages, etc. The Baldwinsville Centifrugal Pump Works were next visited, and the centifrugal pump was examined with much interest. These pumps take rank with the best in the market, and have been largely adopted by the government, dry docks, and many of the leading contractors.

The visitors were treated with a fine collation at the ——— —— brewery, which they very much enjoyed.

The last session was convened at 7 p. m. July 16. After finishing all business, a hearty vote of thanks to the John E. Sweet Council for their liberal treatment of members and visitors, and the great care shown by them for everyone's comfort. Votes of thanks were also unanimously passed to Lieutenant-Governor Edwd. F. Jones for his presence and address at the public meeting in the Alhambra, Mayor Cowie for presiding, and Prof. Sweet for his able paper.

It was resolved that the meetings of the Supreme Council be held bi-annually hereafter, the next meeting to be held in Chicago, the second Monday in May 1893. Special sessions may be called at any time, however, in accordance with the Amended Constitution.

The Council then adjourned.

THE HARRY HOHN FUND.

At last this fund is in a fair way of being brought to a happy and practical end. Brother Hohn was present at the Syracuse convention, and attracted much attention and sympathy. A chair on wheels, was presented to him by the managers of the Orphans and Old Ladies' Home. At the suggestion of Mrs. Jefferson Young tin-type photographs of him were taken while he was at Maple Bay, and $7.85 was realized from the sale thereof. A special collection in the Rink realized $13.70. And the proprietor of Klein Hall (where the John E. Sweet Council meets, and where the Supreme Council sessions were held) gave a donation of $5. A representative of Jenkins Brothers proposed that a special collection be made while at Maple Bay, and he received about $200. The balance of the proceeds of the Engineers' Fair was handed over to this fund, as will be seen in another column. Altogether, the fund is now in the neighborhood of $400, including the contributions that have been acknowledged in our last and previous issues.

A special committee was organized by the contributors while at Syracuse, and it was resolved to increase the fund to $600, and then to buy a good stock of cigars, and fit up a store for him in Philadelphia. Bro. Hohn is a bright young fellow, and very cheerful. He will be able to move about such a store, as is proposed, in his rolling chair, and will no doubt make a comfortable living, once he start.

SPARKS FROM THE CONVENTION.

Were you there? Where? Why to Syracuse of course. If you wasn't you missed the fun. Surely the society of Christian gentlemen and others of reverse proclivities was worth the trip. Such doings as we had were never seen before, and "the boys" all had a good time. Of course Brother Young had to have his say; he always does have a good deal to say whether to the point or not, you must be the judge, but I always thought that his tongue was hung in the middle aud some how or other had assumed a kind of perpetual motion. They say that he is Supreme Chief of the A. O. of S. E., but I think that those that made him so must have been under the influence of the weather or something else.

Then there was Jerry Leahey. Now Jerry is a decent sort of a boy with a wonderful faculty of keeping his mouth shut. No flies will ever find their way into Jerry's mouth when he's asleep, or anything else when he's awake. They do say that Jerry has a wonderful capacity for figures. I don't mean ladies' figures, but just everyday common figures. A most peculiar accident happened to Jerry which resulted in a most serious attack of cramps. Jerry being a "goodie, goodie man" we are only left in a query as to what caused this trouble and if anybody wants to know the real truth about it, they would be likely to find out at 211 East Castle St., Syracuse, N. Y.

And then that good Christian gentleman, Jacks, from Boston. Anybody would know that Brother Jacks was from Boston; so cultured, "don't you know." Brother Jacks has got a peculiar fondness for the ladies and no wonder the ladies are sincerely attached to him, for he betrays so much real sympathy. How do I know? Wasn't all his speech at the opening exercises entirely on love and sympathy? Now Brother Jacks has got two sides to his nature; the good Christian gentlemau, —will the delegates please give the other side? And so we'll leave Brother Jacks, hoping that in the two years that will elapse before a next Supreme Council meeting that he so improves his ways, and demonstrate that love and sympathy should be able to guide a man aright. Good-bye Brother Jacks.

Another Denison of Boston was a gentleman by the name of Borne, who seemed to take a fancy to Brother Lightfoot of Philadelphia, thus forever doing away with the erroneous impression that Boston is quite select. I wonder when these two got married to see them trip the light fantastic toe at Maple Grove, one would have thought they had been raised together. I am sorry to relate that both of these gentlemen have come to that stage in life where a fly on their head is a fearful nuisance. But listen boys; Brother Borne is a loyal member of the Order as you will find later on.

There were many honest men there, such as Weidner, Connor aud Calloway, all of Philadelphia; not forgetting Brother Underwood of course. But then that is natural; Philadelphia is an honest town. This word "honest" as applied now of course must be taken with a little grain of salt, but I think that if they keep on improving when they come to Chicago in '93 they will secure the finishing touches to a well rounded disposition. Send on your cigars, you Philadelphians, that little puff is worth something. And when I think of Brother Callison of Syracuse, that honest (?) man, all hopes of a regeneration of this order seems out of place. They say he used to be honest but I cannot see it; however under the influence of the Philadelphians, whom we understand will visit soon, we think there is a small chance for improvement. Be careful Harry.

But talking about your honest men Tom Oakes of N. Y. takes the cake. Anybody to look at Tom Oakes would naturally think he was a sample boy of the right kind, but he is a greivous disappointment. Tom a little advice to you:—"Go away and hide yourself for a month and wash your soul. Take a little of the fiuid used by that other gay young man, Stiles, and perhaps you will come out once more clean." Tom that was a rotten story you told in the Alhambra and you must do better next time; get your stock in shape before '93.

And what can I say about Deas of Bridgeport, Southwell of Cleveland, Neal of Cincinnati, Hill of St. Louis, Wilson of Wahoo, Neb., Wilson of Oneida, N. Y., Baker of Grand Rapids, Thomson of Detroit, Teller of Utica (John, reform), Schmering of Rochester. They are all tied with the same string. It seems to me that there ought to be some purifying influence put to work among the members of the Supreme Council of the A. O. of S. E. Surely the members of this Order have been under some grave misapprehensions to turn out such delegates as these, but in as much as they are coming to Chicago in '93, there is some hope that under the genial influence of stock yards perfume and Lake Michigan breezes that they will lose some of their——, give it a name, gentlemen.

Brother Cowles, sad to say, is a very two faced man. He has got three smiles, a business smile, a social smile and an excursion smile, and I like a man with only one smile, and is content to take only one smile. Mr. Cowles made quite an impression among the ladies and got pretty well acquainted with a certain lady from Rochester, and I think it is wroug for any man to leave his wife at home and to try and make an impression on such an elegant lady as Rochester sent to Syracuse. I cannot see how the A. O. of S. E. hope to have a good organ when superintended by a man of this kind. Brother Cowles will surely come to a violent end.

And now leaving all joking aside and letting the foregoing stand for what it is worth I would like to say a few words more in commendation of the members of the John E. Sweet Council, No. 6, and of its namesake, Prof. John E. Sweet. Every member who went to Syracuse cannot but feel that Secretary Kellogg worked assidiously for the comfort of each and every visitor. He has the ability of seeing a good many things at once and one would almost think he had eyes in the back of his head. You did your duty well Brother Kellogg; keep on developing such a good quality. And then we come to think of those two excellent fellows who hold out at the Crystall Springs Brewery of Syracuse, I cannot but feel that John E. Sweet Council is fortunate both in name and men. It is well for the Order that Prof. Sweet is a friend and sympathizes with it and members of the Order everywhere should secure a copy of his paper read before the Supreme Council, as being the proper idea of what an engineer should be. All Hail! Brother Sweet; your name shall be ever green in the memory of the Order. It is a subject for congratulation that the members took hold with a right good will in endeavoring to place Brother Harry Hohn of Philadelphia above the reach of want. This is a matter in which every council should have a voice; following the words of the Divine Master "that it is more blessed to give, than to receive." Let the good work started at Maple Bay not be dropped or allowed to lag until this brother is taken care of for all time. The American Order of Steam Engineers is a glorious Order and every member of it should feel that he is a committee of one to bring in good men and help try to swell its ranks, and in conclusion I would advise the people who delight to sojourn at 211 East Castle St., Syracuse, N. Y., to beware of 95 per cent. pure——and bismuth and beware of the dog.

Dr. Blue Blazer.

THE PROPOSED INDUSTRIAL UNIVERSITY.

Prof. John E. Sweet, of Syracuse, N. Y., sums up the discussion of this important question in the *American Machinist* of June 25. Prof. Sweet says:

As the criticism brought out by the original paper on the above subject has been so largely (in point of numbers, at least) antagonistic to the scheme, no doubt most of your readers are by this time of the opinion that there is no ground for further argument. But it is best to remember that, while any proposition of a radical and novel nature must of necessity be largely dependent for its support upon opinion, and battle against the facts of precedents, it does not follow that the heavy side of the argument is necessarily in the right. The author will not attempt to dispute what has been said against the scheme where the statements bear upon their face simply that of an opinion, because one man's opinion may be worth as much as another's, provided he has equal opportunities to obtain facts upon which to form an opinion, and is equally unprejudiced otherwise. The writer does not pretend to say that his forty-two years of work as apprentice, journeyman, foreman, draftsman, superintendent, instructor and proprietor, makes him superior, or even equal to others, but if a fair use of the opportunities for observation has been made, likely it is as good as it ever will be.

The scheme was the outgrowth of years of experience in teaching; years of observation since; the careful following of the result of his own work as a teacher upon the students; the result of the work of other teachers, and of the various technical schools of the country; the result of his own apprenticeship system, and the system followed by others within the range of his observations. Added to this is another opportunity not embraced by all men, and that is responding to the frequent application of proprietors for men to fill responsible and ordinary places, and the constant application from good men to find suitable places for them. So much for egotism as a statement of the basis upon which the original proposition was founded.

A half century ago, ministers, doctors, surgeons, school teachers and mechanics were men trained by the apprenticeship system. Is it not a fact that in all, except the last, the system has been superseded by the schools for special training? Whether the best ministers of to-day are better or poorer than the best of the old school, or whether the average of the old school was better than those of to-day, we do not know, but is it not a fact that the system has been changed? Is it not the same with the lawyers, doctors and teachers? Are they not now made up to the same point by the schools that they were by the apprenticeship system? The question in these thing, as to whether they are better or worse, is entirely irrelevant to the question under discussion, because these things are the training of the intellect, and not of the hands, and the irrelevance is admitted; but what are the facts in the case as regards the surgeon? Will any one for a moment claim that the surgical student, whose only opportuuity was the every-day practice of his superior, could possibly become as skillful as if he had the more opportunities for observation and practice in one year at the medical school or hospital, than he got in a lifetime through local practice?

It matters very little whether the school proposed be designated as a school, penitentiary or hospital; the fact ought to be apparent that facilities would be at hand where the pupil could have opportunities to learn more in a year than the average apprentice gets in three, and further, where it is the business of the man to give instruction, that he would be more likely to do it than where he is employed for another purpose, and when in many cases it is against his interest to do so.

It is not claimed that a mechanic of a lifetime's experience could be turned out in three years, nor that the same boy could learn more in one year, and be a better workman with one year's schooling than the same boy would be after a three years' apprenticeship, but what is claimed is this: That such a school could turn out boys at the end of three years that would be just as good workmen as the same boys would make if regularly apprenticed at the average shops after three years' service, and a good deal better men out of the same boys than if they were forced to run wild in the streets.

It is possible that, assuming, as was done, that the apprenticeship system had largely died out, that the conclusion was based on too limited knowledge, and that really, as one claims, the apprenticeship system fills the requirements. It may be, too, that the one conclusion was based upon too limited knowledge.

It may be that the apprenticeship system is the best. We are all liable to think that the way we acquired our experience was the best; the writer having been an apprentice himself, it is not easy to see why he would be more likely to under-estimate its value than others.

It may be, as some one wishes us to believe, that there is going to be no more use for skillful machinists, and that machine operators will operate machines to build machines for other operators to operate, and yet others may think there will still be a field for machine repairs where a certain kind of skill will be required, and it is possible that there may be still other new machines invented that will give employment to more good workmen than one

visionary institution is liable to turn out. When machine construction and operation will have become so perfect as to no longer require skilled mechanics, mankind will obey the commandments, ministers and churches be abolished, and sanitary science reach such a state of perfection that mankind will live on without doctors, and bones grow together without setting.

It is claimed by critics, and feared by others, that the proposed plan looks forward to the rich man's school. The writer does not see it in that light, or even in the remotest degree contemplates any such thing. The rich man sends his son to college, and yet all colleges are not rich men's colleges; at Cornell University a large minority are poor men's sons.

The poor man who has made his way in the world, and is determined to do better by his son than he fared himself, finds means to send him to the high school or academy, and why not to the industrial school?

At our college public-spirited citizens endow scholarships, whereby poor and worthy students receive help. The State gives large sums of money to promote education, general in public schools and special in the medical, law and normal schools, and the State has as much right to pay to help make the poor man's son a shoemaker as the rich man's son a lawyer. But before it is possible to acquire this aid, it has to be proven that it is desirable, that it can be accomplished, and this experimenting, has got to be done, if done at all by the rich man's money, and the experiment might as well be tried on the rich man's son, that is, if one sees fit to call the well-to-do citizen the rich man.

But there is another view of it, and this is the first time the writer has ever ventured the expression of the thought: Is it any worse for the poor man's son to go to the "eternal bow wows" than for the rich man's son, who the more often of the two carries down another with him?

There is a hint thrown out that the work would be of the prison labor sort, and, to use the common expression, "would take the bread out of the honest workman's mouth." It has never been the writer's misfortune to see an honest workman who ever feared honest competition. Plenty of men rail at the prison labor, who could not themselves do an honest day's work to save their souls, that is, according to others' ideas of what constitutes an honest day's work.

The idea is advanced that the result would be a class of dude mechanics. That is exactly what it would not be. The whole plan looks forward to turning out a set of thoroughly well-trained apprentices, who, while they have been acquiring the essentials of the trade, have gained such general knowledge as is likely to be of use to them through life, and many of whom might acquire that gift of all gifts—the learning how to learn. No one would spend any length of time in the place without getting value received, and those able to advance beyond the trade and general knowledge furnished by the institution would in no way be hindered or retarded, but fitted to go ahead.

Reference was made to the English premium apprenticeship system to show that people would pay the money. Mr. Booth shows that the premium apprenticeship is in bad repute, and that they all aim to something higher than machinists. That likely is true, but it does not prove that premium apprentices in an engineering establishment, where a few privileged boys, among a number of others not so privileged, are spoiled—it does not follow that where the whole school are equal, all will get the "big head" because they have to pay for their education.

It is not plain why the result of the Whitworth scholarship has any unfavorable bearing on the subject. Taking a good mechanic and giving him a technical education, the result that ought to be expected is that he seeks a position either where his technical knowledge will be paid for, or where he can make a living with less work, and so, too, take our boys who have no chance to do anything but laboring work, and give them a trade, and it is rather to be expected that they will work at that trade, rather than go back to ordinary day labor.

We are told that the author had better devote his time to improving the trades unions, if there is any room for improvement. It is one of the commonest of human traits, this saying what rich people ought to do with their spare money, or how those working for the general good ought to work. It is not probable that any of us will ever make much success of what we undertake, unless we have faith, and the writer has no faith in his ability to improve the trades unions. If any others thinks they can, the writer has not the least objection, nor will he ever suggest that they had better be turning their attention to something else. It is hoped, however, before they begin, they will try owning a shop, and have it run by the trades unions.

Radical as was the proposition to make the school the attachment to the shop instead of the shop an adjunct to the school, "Bell Crank" goes further, and questions the necessity or use of the school part altogether.

The author had thought that a pretty good knowledge of drawing, where a young man was in a position to get a comprehensive idea of the relation between the drawing and the thing itself, was rather desirable to have. Whether "Bell Crank" intends us to believe that drawing is not of enough use to the machinist to pay for the trouble, or that he can get what he needs at the public school, is not made clear; if the instruction at the public school is enough, all boys do not get it. There is something in applying mathematics in practice that puts a different phase upon it than is possible in the school-room.

In regard to lectures: There are three ways to learn how to do a thing. The best way to get at it and do it, the next to be told and the poorest to read about it. There are many things to be told and talked about and argued, which might as well be told to a hundred, all at once, as to each one separately, and the general discussion of a mechanical subject, or any subject that will cultivate the faculty of speaking in public, ought, if such a thing is desirable, be enough to justify the lecture room attachment. These may be only the same things as the public schools furnish, still it is believed there will be found a great difference between the school training, where so much is assumed, and where the work, if properly managed, would show and be based, on the apparent fact.

Learning to make drawings and working out the drawings of something that is to be made; solving imaginary problems and figuring out some shop gear; copying letters from the ideal letter writer, and writing a letter on business; discussing a subject in debating school and arguing the case from the facts before you, are quite different things.

It has been pointed out in the discussion, that handicraft, both in skill and appreciation, has greatly fallen off since the days of the building of the old cathedrals. This is true, certainly, in the line of architecture at least, and lamentably so. Handicraft is still appreciated to a certain extent, but seldom, except when directed to the useless or ornamental. The sleight of hand performer, the jugglers the gymnast, whether in the ring or performing on the piano, receive as much pay and applause as ever, but it is deplorably true that handicraft, when applied to useful purposes, with perhaps the exception of the surgeon and optician, meets with but little appreciation and less reward. However, thought and sentiment, love, admiration and generosity, like the tide, like commerce, faith and finances, ebb and flow, and when the pendulum swings the other way, handicraft may again receive due appreciation and attain its proper place. The writer is not ashamed to admit, in fact, has the courage to say, that he hopes the time will come when man's worth will be measured by what he can do, and his use to the world rather than by his birth, his money or his knowledge. This may never come; it may not be right that it should, and possibly one is inspired to express this hope from the same motive that leads aristocracy to claim the *right to rule*, that makes the wealthy claim that *money is king*, or the highly educated that *brains are supreme*.

"I ain't goin' to send any more money out to the heathen," said Willie. "I seen a picture of one of 'em this mornin,' an' as far as I could see, he didn't wear any pants, and so hasn't any pockets to carry the money in."

"THE WORLD."

This is the name of an ingenious contrivance just completed by James Sherry, of North Pownal, Vt., says a writer in the *North Adams Transcript*. It consists of a platform, on which are placed the figures, with a stage ten feet by four, under which is located "the life" of the army of silent workers on the stage.

The bricklayer is seen, clad in the garb of his calling, building the chimney on the new station. This venerable chap picks the brick up, places it in its place on the chimney and then, as if not satisfied with his work, again takes the brick from the wall, removes the rough edges and returns it to its place and, with a few well-directed taps, places it firmly in the imaginary mortar.

The old man is there sitting in his easy chair, evidently counting the hours as they flit by, as he gets up every few minutes and takes a look at the sun, and then at what is going on around him, and returns to his chair. The indispensable railroad is there with the latest equipped trains, while men are seen engaged building a new depot to replace the old one. Their intentions can readily be discerned at a glance, and, as we look at the old depot, a couple, who have become impatient waiting for the train, walk out from the door and across the platform, take a look for the train and return to the depot. They are evidently in love, as the gentleman is loth to let go his lady's hand even after they are inside the station lest he may lose her in the crowd that is waiting for the train. They are soon rewarded, however, for waiting, as the train is seen coming down the straight line of track to the depot from what is made to represent the "Hoosac Tunnel," and as the train gets nearer we observe it to be a Fitchburg train laden with the usual heavy load of passengers all in the best of spirits. As we gaze at the depot the curtain of an upstairs window is seen to rise, giving us a view of married life, which represents a man lying in bed while his faithful wife, who has become tired of calling on him to get up, stands by the bedside, hammering him in the face with her fist. As the train comes nearer the station the curtain is dropped and a flagman comes out to announce the arrival of the train.

The new and old way of getting out lumber is shown. The old way is represented by two men, one standing on a frame on which rests the stick that is being ripped up, the other man underneath, working as men would work with a "cross cut" saw, the one underneath looking up now and then to see that he is keeping the saw on the line. The modern saw mill is seen with a man (the sawyer) standing at the carriage on which is placed the log and moving levers with first one hand and then the other, the carriage is run back and forward in the most natural manner; while at one side is seen a man working at a small saw but evidently not attending to business. He pushes the stick on the saw, "chokes" it so it stops, then turning his head he sees what he has done and removes the stick again.

Two gates cross the railroad track and gatemen open them as the train approaches and close them again after it has passed. A woman is seen running a sewing machine, while near by are two men framing a building, one working with hammer and chisel, the other boring for mortices. On a small lake in the center is seen a steamboat, sailboat, and a man in a rowing boat, the latter evidently about to be run down by the steamboat, as he seems rowing for all he is worth to keep out of the way. At the left of the lake are seen four bicyclists running in a circle, two going in each direction. A man sawing wood is quite natural. This fellow, evidently working by the month, stops now and then to look around and see that the rest are busy.

A fireman running boiler and engine, carpenters at work on a staging, and other figures fill up the space so that one can look for an hour and still see something new. Pulleys and belts are required to run the numerous figures.

"Never sell a horse to a friend" is a good maxim to follow, but a better rule is never to buy a horse from a friend. The one saves your feelings and the other your money.

PROTECTION OF WATER.

The Maine Legislature has passed a bill entitled, "An Act to Protect Waters used for Domestic Purposes," of which the following are provisions:

Sec. 1. Whoever knowingly and willfully poisons defiles or in any way corrupts the waters of any well, spring, brook, lake, pond, river or reservoir, used for domestic purposes for man or beast, or knowingly corrupts the sources of the water supply of any water company, or of any city or town, supplying its inhabitants with water, or the tributaries of said sources of supply in such manner as to affec the purity of the water so supplied, or knowingly defiles such water in any manner, whether the same be frozen or not, or puts the carcass of any dead animal or other offensive material into said waters, or upon the ice thereof, shall be punished by a fine not exceeding one thousand dollars, or by imprisonment not exceeding one year.

Sec. 2. Whoever shall willfully injure any of the property of any water company or of any city or town used by it in supplying water to its inhabitants, shall be punished by a fine not exceeding one thousand dollars, or by imprisonment not exceeding one year; and such person shall also forfeit and pay to such water company, city or town three times the amount of actual damage sustained, to be recovered in an action of the case.

Sec. 3. The provisions of all general laws, and of all special acts inconsistent with this act, are hereby repealed.

STEEL PIPES.

The Steel Pipe Company, of Kirkaldy, have done something toward showing the advantages possessed by steel over wrought iron pipes. It is stated by Mr. D. J. Russell Duncan, Assoc. M. Inst. C. E., that wrought iron or steel pipes can be produced at a less cost per unit of length t an cast iron pipes. A pipe built of steel can be made at a less cost of labor than one of wrought iron, on account of the reduction in the number of plates and rivets, and, therefore, of calking and punching. Being less liable to corrosion than pipes of wrough. or cast iron, the durability of steel is insured. It is stated by one authority that the best precaution is to have the pipes galvanized, then coated with natural asphaltum or with a composition of pitch, tar, petroleum, linseed oil, and chalk. This solution is heated in a bath to a temperature of 250°, and the pipes immersed till they acquire the same temperature as the composition. The pipes should also be coated as they are laid in the trench. As regards strength, the steel pipe is much superior to glazed stoneware or cast iron, or about three and a half times stronger than the latter. Mr. Duncan says: "As steel is on an average 1-3 times stronger than wrought iron, it is clear that for pipes of equal strength of plate, and allowing that the rivetted or welded seams are of equal strength on both, the thickness of mild steel need only be about 0.77 of the thickness of wrought iron." This economy of material can be effected, as the *Sanitary News* observes, by using open hearth mill steel of the highest possible tensile strength.

NEW WAY OF MAKING STEEL.

At the Technical School, Sheffield, England, a new method of steel making has been tried, with marked success it seems. A new experimental open hearth furnace having been completed, the getting out of the first heat was an unequaled success, says the *Sheffield Telegraph*, and the ingots teamed were of a composition never previously made in the history of steel. This entirely new process, which is the outcome of the researches recently performed by Professor Aruold, opens up possibilities for the cheap and rapid manufacture of high-class steels, which are likely to bring about a revolution in the present processes of manufacture. The process consists in practically removing the whole of the impurities from Swedish pig-iron with the exception of the exact proportion of carbon required for a given purpose, thus obtaining the ideal carbon and iron steel, homogeneous in structure and absolutely free from blowholes, these results being obtained without the presence of more than mere traces of manganese and silicon, and also without the use of iron ore. The average time occupied by this process in the conversion of a ton of pig-iron into the highest class of steel yet made will be about three hours, the fuel used consisting of about half a ton of rough slack.

SPECIAL BUSINESS NOTICES.

The Keystone Electric Co., of Erie, Pa., manufacturers of motors and dynamos, recently installed a 35 light dynamo and plant in the pumping station of the Erie (Pa.) water works department. They have just sent a 5 h.p. reversible elevator motor to the Marshall Bros. Elevator Co., of Pittsburg, Pa. And they have nearly finished two 5 h.p. (500 volt) reversible elevator motors for the Pittsburg Plate Glass Co,, at Ford City, Pa., also a 7½ h.p. (500 volt) reversible elevator to go to Sangamon, Mich., for the Barrett Elevator Co. They have also recently sent a 2 h.p. and a half h.p. motor to Warren, Pa., and installed a 3 h.p. motor in the *Sunday Globe* printing office, Erie, Pa., as well as a 2 h.p. motor in a wire fence factory at Erie.

The Lidgerwood Manufacturing Co., New York, Chicago and Boston, are doing an immense business in their standard hoisting engines. They are enlarging their present works in Brooklyn, N. Y., and have just opened a branch house in Pittsburg, at 99 First Avenue. It will be in charge of Mr. A. G. Harmes, of that city, and anyone desiring anything in the line of hoisting machinery will do well to give him a call.

THE AMERICAN ENGINEER is kept on file at E. C. Dake's Advertising Agency, 64 and 65 Merchant's Exchange, San Francisco, California, where contracts for advertising can be made for it.

CABLE ROADS.

An Engineer, perfectly conversant with the German system of cable-road construction, and owner of abundant material in finished rails, and all requisite tools and appliances, belonging to the business, seeks a connection with an appropriate firm for the building of cable-roads, on a basis of a salary and percentage. Address

RUDOLF MOSSE,
Dusseldorf, Germany.

CONTRACTS OPEN.

Stand Pipe.—Sealed proposals will be received by the Trustees of the Illinois Northern Hospital for the Insane, until 12 o'clock, noon, August 4th, 1891, for furnishing the material and erecting of a stand-pipe of 100,000 gals. capacity upon the grounds of the said asylum, at Elgin, Illinois, according to the plans and specifications on file in the office of the superintendent. Each proposal must be signed with the names of the party or parties interested and must contain a deposit in cash or a certified check for 10 per cent of their bid, which will be returned to the unsuccessful bidders. The successful bidder will be required to furnish an approved bond for the faithful performance of the work. Proposals will be addressed to the Trustees of the Illinois Northern Hospital and marked "Proposal for stand-pipe." The right is reserved by the Trustees to reject any and all bids. H. J. BROOKS, Superintendent, W. S. GAMBLE, Engineer.

Water-Works.—The Village of Madelia, Watonwan County, Minn., will let contract to the lowest responsible bidder July 29, 1891, at one o'clock p. m., for high tank and water mains. Right reserved to reject any and all bids. $9,000 to be expended according to the plans and specifications on file in Recorder's Office. C. COOLEY, Recorder, Madelia, Minn.
Dated June 27, 1891.

Sealed Proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D C., until the 30th day of July, 1891, for all the labor and materials to fix in place complete the low-pressure, steam-heating, and mechanical ventilating apparatus, etc., and the concrete floor of basement for the U. S. Courthouse and Post-Office building at Louisville, Ky., in accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Superintendent at Louisville, Ky. Each bid must be accompanied by a certified check of $500. Proposals must be inclosed in envelopes, sealed and marked, "Proposal for Low-Pressure, Steam-Heating, and Mechanical Ventilating Apparatus, etc., and the Concrete Floor of Basement for the U. S. Courthouse and Post-Office Building at Louisville, Ky.," and addressed to W. J. Edbrooke, Supervising Architect.

Sealed Proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock p. m. on the 28th day of July, 1891, for all the labor and materials required for the iron stairs, iron work, etc., of elevator shaft, for the U. S. Court House, Post Office, etc., building at Denver, Col., in accordance with drawings and specification, copies of which may be had on application at this office, or the office of the Superintendent at Denver, Col. Each bid must be accompanied by a certified check for $200. The Department will reject all bids received after the time herein stated for opening the same; also bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in envelopes, sealed and marked, "Proposal for Iron Stairs, etc., for the U. S. Court House, Post Office, etc., building at Denver, Col.," and addressed to W. J. Edbrooks, Supervising Architect.

Pump.—Bids wanted for one duplex steam pump, 4-inch discharge. Water to be forced up an incline of 1,700 feet—perpendicular 45 feet—total height 100 feet. State number of gallons guaranteed per hour with 20-horse boilers, 50 pounds pressure, also one 20-horse flue boiler without firebox, including smoke-stack, gong, whistle, good size gratebars, boiler not less than 5-16 thickness of steel, also 2,000 feet cast-iron water pipe 4-inch, also 3,000 feet 6-inch cast-iron water pipe, four 6-inch elbows, one 4-inch elbow, elbows to be large in centre, 6-inch pipe to have connections for at least four fire hydrants, also six connections for 4-inch pipe. Separate bids taken. Send bids to Sam Walker, Milledgeville, Ga.

Viaduct. — Proposals for constructing a viaduct.—Rock Island Arsenal, Rock Island, Ill., June 23, 1891.—Sealed proposals, in triplicate, will be received until 2 o'clock p. m. on Saturday, July 25, 1891, for furnishing, constructing and erecting the iron and all other work complete, except masonry, excavations and fill, for a viaduct from south end of the Rock Island Wagon Bridge, between Rock Island and the city of Rock Island, over the railroad tracks which adjoin the approach to the said bridge, including the raising the said bridge to an inclination required to form a continuous roadway with the viaduct. Plans and specifications, with full instructions, stipulations, etc., and the blank forms on which proposals must be made, can be had on application to Captain M. W. LYON, Ord. Dept. U. S. Army, Commanding.

AUGUST 1, 1891. **The American Engineer.** VOL. 22, NO. 5.

UNIVERSAL TOOL GRINDING MACHINE.

The illustration on this page represents a new and very much improved machine for grinding lathe and planer tools. And on the next page will be found a chart for grinding said tools. This "Universal" tool grinding machine is the invention of Mr. C. M. Conradson, superintendent of the Gisholt Machine Co., Madison, Wis. Mr. Conradson is also a member of the firm.

In placing this machine upon the market the Gisholt Machine Co. feel that they satisfy a desire to fill a much-felt want of numerous manufacturers, and provide a systematic and precise method of shaping and sharpening lathe and planer tools used in manufacturers' shops.

"Tool grinding machines, strangely enough, are of comparatively recent origin," as the *American Machinist* remarks; "strangely enough when it is considered that so much depends upon the condition of the cutting tools that are used in the various operations connected with machine work. Nothing is intended in this as in any way reflecting upon the skill of the machinist to put his tools in proper shape to do the work required of them. But doing this is not a desirable job; it is something that the machine rather than the man should do."

The following, from the Gisholt Machine Co.'s prospectus affords interesting reading:—

While great progress has been made in all departments of shop work, the methods of sharpening lathe and planer tools remain to-day essentially the same as in the time of James Watt.

Absolutely no progress has been made in this particular, and while every effort has beem made to improve machine tools, the cutting tool remains the same. Maudsley and Nasmyth would have nothing to learn in this regard in most of our modern machine shops; on the contrary, they would see that their methods had been forgotten, and that the greatest waste results from the use of tools not well adapted to the work.

The importance of adopting a standard shape of cutting tool has been recognized by all trades except the machinist's. In ordinary shop practice the greatest diversity exists, which results in waste both in making the tool and in its operation.

It is a self-evident proposition that for every class of work a tool can be designed that will be most efficient. "Universal" tool grinding machine is intended to take the place of the grindstone and emery wheel, and is so constructed that any tool can be readily duplicated. The essential difference between this machine and the grindstone is that the tool is rigidly held in a suitable holder while being ground.

There is just as great an objection against holding a tool by hand while being ground as there is to holding it by hand in the lathe. One method is as efficient as the other.

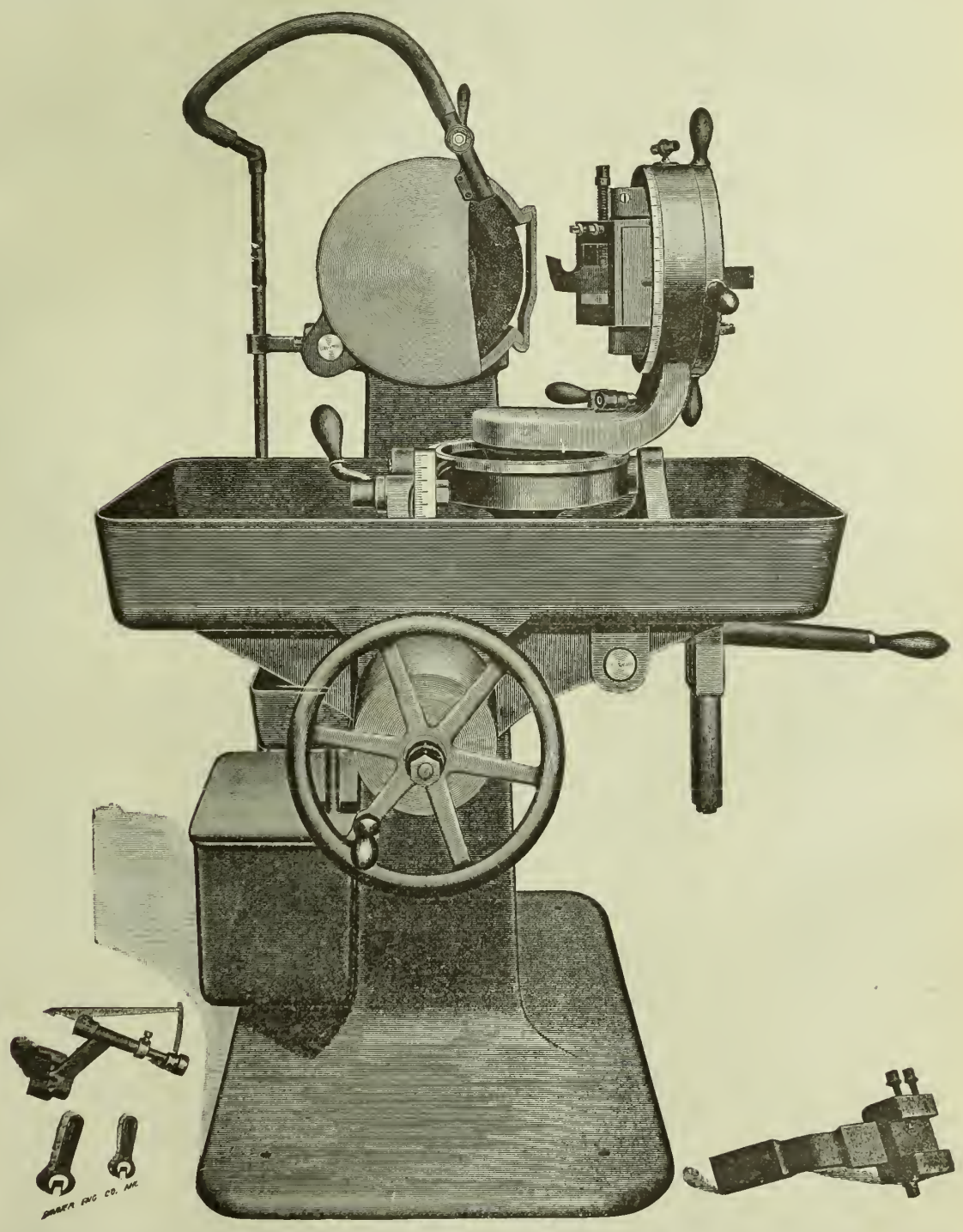
The Universal tool grinding machine has been thoroughly tested by use in a large number of the best shops in this country and is now offered with full confidence in its merits.

The following advantages are claimed over any other system of grinding:

1. The tools are more efficient in operation.
2. It costs less to sharpen tools on this machine than by any other method.
3. Tools last longer at each forging, because there is no waste in grinding.
4. Machine tools can be kept continuously at work.
5. Special tools are readily ground.

Dilating upon the fourth feature the manufacturers say, with good reason, that considerably increased output from machine tools results from the use of this system, as the machine can be kept continuously at work, and need not be stopped while the operator sharpens his tools on the grindstone or emery wheel. Again, machine-ground tools generally are more efficient in cutting and are more durable than tools ground by hand, for the reason that the best form of tool for the work in hand can be chosen and obtained indefinitely. There seems to be no good ground for believing that it is necessary for one man to have a differently shaped tool from another when doing the same work. On the contrary, there is every reason to believe that by judiciously designing standard tools for the various classes of work to be done, that the average output from machine tools can be greatly increased.

Machine-ground tools last much longer at each forging than if ground by hand. The universal tendency among workmen is to grind tools where wear occurs, neglecting the portion of the tool back of the cutting edge, thus speedily reducing the clearance and rake of the tool. Consequently the tool does not cut as freely, and heats and wears away much more rapidly than when first forged. It is believed to be a fact that many hand-ground tools have not sufficient clearance to work well, or enough top or side rake to sever the metal operated on easily. This, of course, necessitates frequent grinding and consequent rapid deterioration of the tool. With the Gisholt Universal machine, grinding takes place not only at the extreme point, but over the entire surface of the cutting point, thus maintaining the shape of the tool till worn out. By this means the action of the tool is uniform, and the tool can be relied on to operate as freely when nearly worn out as when new. It may be mentioned here that machine-ground tools generally cut much freer than hand-ground tools, and thus heavier cuts may be taken.



The machine illustrated herewith is simple in construction, as our contemporary already named observes. And any intelligent man may soon learn how to use it. There is a column in which is journaled the emery wheel arbor. Through this column is forced a heavy circular arm, upon which a pan supporting the tool holder oscillates. The pan is also arranged to be moved transversely on this arm. It will be readily seen from this that a tool held as represented may be brought against the face of the emery wheel and carried across it forward and back by oscillating the pan by means of the lever shown at the right of the principal cut on this page. The tool holder is arranged to slide in the pan in a direction parallel to the arbor. The tool to be ground is held in this, and may be moved about four different centers, as follows:

1st.—If the tool is bent it may be moved 30 degrees either side of the center line to bring the face to be ground parallel to the face of the emery wheel.

2nd.—A tool may be rotated through the full circle about its own axis as a center, as for grinding the sides and top.

3rd.—A tool may be rotated through 320 degrees in a horizontal plane for grinding the angular faces.

4th.—The entire tool holder may be rotated in the base to the extent of 15 degrees on either side of the horizontal for the purpose of obtaining clearance. Any required clearance can be had, as on thread tools, without distorting the top angle, and without calculations.

The attachment shown on the floor at the right of the accompanying engraving is used for grinding inside tools; the one at the left is for setting tools to be ground round-ended. The arbor of the machine is of crucible steel, ground on dead centers, and fitted to bronze boxes by scraping. The

boxes are adjusted by nuts on either end. End thrust is taken by a hardened steel collar against vulcanized fiber washers.

The accompanying chart is furnished for the guidance of the person who operates the machine. The angles indicated are those to which the various adjustments should be made, by the aid of the graduated arcs for the purposes named. All the tools shown in this chart are furnished, ready ground, with each machine; they are of such forms as experience has shown the builders to be well suited to their several purposes. Of course this chart is mainly intended as an aid in starting the machine, and is by no means absolutely necessary; It may be departed from to any extent thought best, or an entire new chart may be prepared.

"ENGINEER" IN NAME ONLY.

According to *The Critic*, of Louisville, Ky., that city, of more than 160,000 inhabitants, is saddled just now with a City Engineer that is sorely lacking in essential fitness for office. It seems that in a trial now in progress concerning the responsibility of the city of Louisville in connection with a street paving contract the competence of the City Engineer was brought into question. The attorney for the contractor proceeded to examine the engineer in the rudiments of mathematics, and this individual was either the subject of a bad case of "stage fright," or he was put into office for other qualifications than engineering knowledge. A straight line, according to his light, was one he supposed "would run without interference as to its course." A right-angled triangle "lies at right angles to the other," and just what an isosceles triagle was he honestly confessed he did not know. But the climax was reached when, after defining a hexagon and an octagon as "six and eight-cornered articles," he declared that "a paragon" was an "eight-cornered instrument." It is unnecessary to follow this shameful exhibit of ignorance further, except to mention that this "engineer" deemed that his full duty in superintending street paving ended when he was satisfied that the "asphalt was put on of the proper thickness."

It is difficult to realize that a prominent city, the engineering affairs of which were long under the control of competent engineers, should be so thoroughly handed over to short-sighted political power as indicated in this appointment. Who this "engineer" is we do not know, never having before heard of him. While we can conceive of certain rudimentary mathematical problems that it might puzzle even an engineer for a time to answer in exact geometrical terms, he should at least know what was meant by the question and in his own language express his meaning clearly. Assuming that this trial was fairly reported in the paper quoted—and there seems to be no reason to doubt this—we have here but another instance of the subversion of an engineering office to purely political and personal aims. We do not blame this particular "engineer" for accepting an office for which he was not fitted, so much as we condemn the authorities who are so lost to a sense of the fitness of things and hold the fair fame and honest needs of their city so lightly as to appoint him.—*Engineering News.*

THE TENSIONS OF STEAM.

In a paper read before the Academy of Sciences recently, M. Cailletet communicated the results of the researches which he had made, in conjunction with M. Colardeau, as to the tensions of steam saturated to the critical point, and the determination of that point. The paper gave the results of the application to the particular case of water of a method which the authors have recently made known, which permits of determining the tensions of saturated steam and the critical point of a liquid enclosed in a non-transparent receptacle. As is known, water heated to a high temperature in a glass tube attacks it and destroys it. This method consists in enclosing varying weights of the liquid under study in a steel tube connected with a compressed hydrogen manometer. This tube can be heated in a bath of nitrate of soda and potash in fusion up to a temperature near red heat. The pressure of the steam is measured for each temperature, and in each case a curve of the results is constructed. All of these coincide up to a certain point, from which each takes a direction which depends on the weight of the liquid employed. The two co-ordinates from this point on the curve represent the critical temperature and pressure. This temperature, from which steam ceases to be able to retake the liquid state, whatever be the pressure exercised on it, is 365 deg. The part common to all the curves gives the experimental law of the tensions of saturated steam, which was only known, from the works of Regnault, up to a pressure of 25 to 30 atmospheres. This curve had been compared to the theoretical data furnished by the researches of different scientists, particularly Clausius and M. Bertrand. This comparison, which gave the most satisfactory agreement, was very interesting on account of its consequences for the works on thermodynamics which of late years have extended so widely. The Eiffel Tower open air manometer was used for the first time on this occasion. It permitted of obtaining with great certainty the value of the pressures measured in the experiments, for the compressed hydrogen manometer referred to above was only used as a provisional intermediary, and was graduated directly by comparison with that of the tower.—*Mechanical World*, (London).

WHAT STEAM USERS SHOULD KNOW.

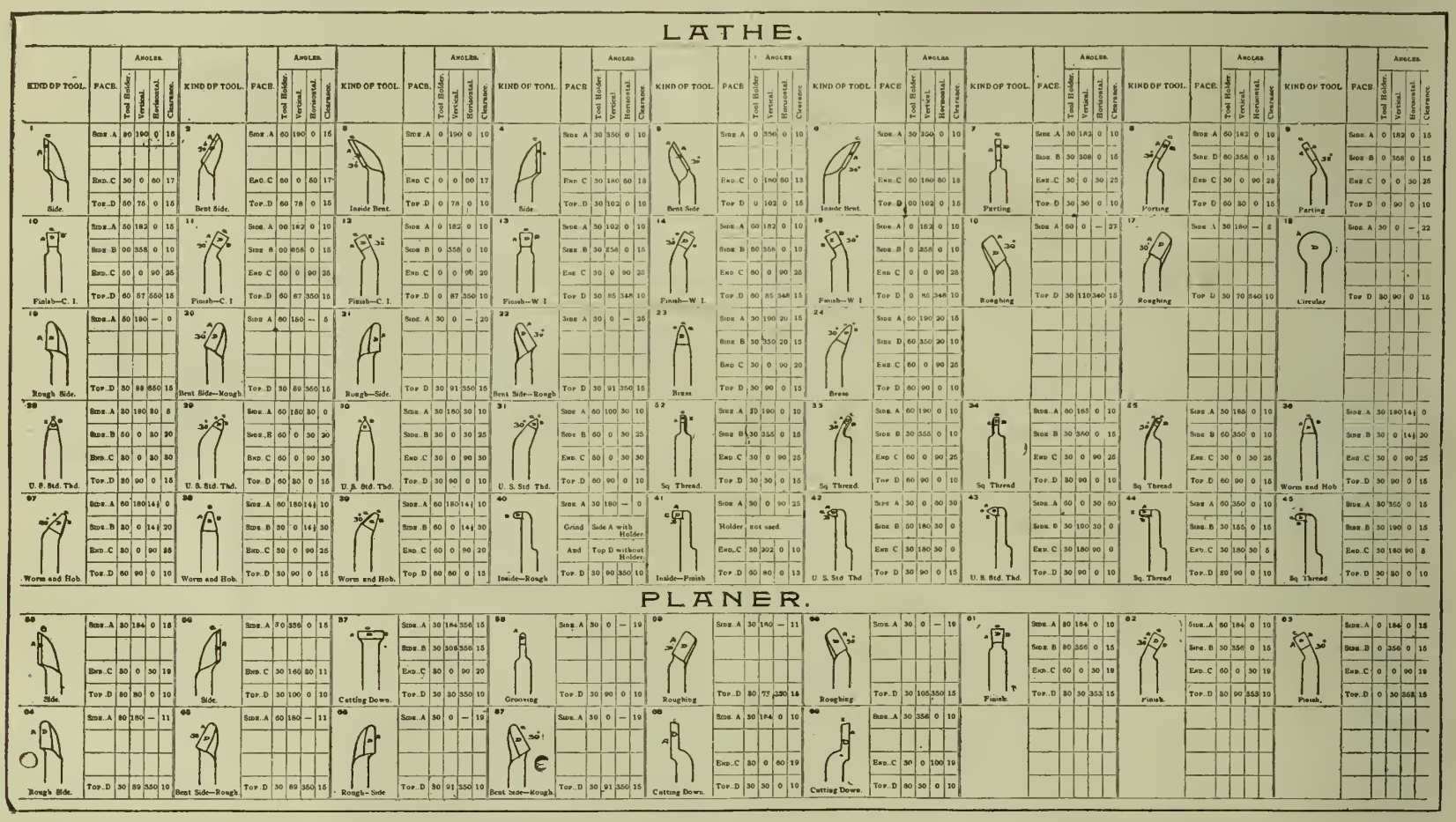
A fair "horse-power" in a steam boiler is an evaporation of twenty pounds of water per hour from a temperature of 212 degrees.

Ten pounds of water evaporated from a temperature of 212 degrees for each pound of coal is high economy. Six pounds would be fair work and above the average.

Under the best conditons a horse-power can be had from an evaporation of less than twenty pounds of water.

A measure of some kind that will show the weight of feed-water passing into a steam boiler with accuracy should be used with all boilers when economy is an object.

Every owner of steam power should weigh the water evaporated in his boiler and also the coal used to produce such an evaporation.



Gisholt Machine Co's Chart for Grinding Lathe and Planer Tools.

It should be the duty of a fireman to know the weight of fuel used as well as the weight of the water.

No man has any right to find fault with the economy of his boiler until he knows the amount of water evaporated per hour and the amount of coal required to produce the same.

In getting the evaporated power of a steam boiler it is necessary that the steam should be dry to get a fair result.

A boiler that carries out water with its steam may show a large apparent evaporation, but the steam being wet is of less value in the engine. A boiler should give dry steam in all cases. Superheating is beneficial.

Boilers that are overworked necessarily waste fuel.

The only way to know where the fault lies is to know by absolute weight the amount of evaporation in the boiler.

A boiler may generate steam with great economy and, owing to the steam being wasted by improper application to the work through the engine, the result in work be very unsatisfactory and the boiler blamed unjustly.

A boiler taxed to its full evaporative power evaporates about five pounds of water to one pound of

coal; double the size of the boiler and you will get the same amount of steam with probably thirty to fifty per cent less fuel.

When steam is used expansively, under the best conditions, it will give double the power for the same amount of steam that can be got from it worked at full stroke without expansion.

When steam is used in non-condensing engines at low pressure the loss is great, owing to the pressure of the atmosphere (fifteen pounds) being a greater percentage of a low than a high pressure.—*Tradesman.*

THE COLBURN DRILLING MACHINES.

The illustrations on this page show the leading features of (Fig. 1) Colburn's No. 5 portable drill with power transmitter connected, (Fig. 2) universal countershaft, and (Fig. 3) an enlarged view of the patent power transmitter.

The power transmitting device, shown in Fig. 3, can be used for driving portable cylinder boring and valve seat facing machines, in use in locomotive repair shops, and where a light power is to be applied, as well as in connection with the Colburn portable drills. The two guide pulleys are arranged in a swivel frame so as to guide the rope or

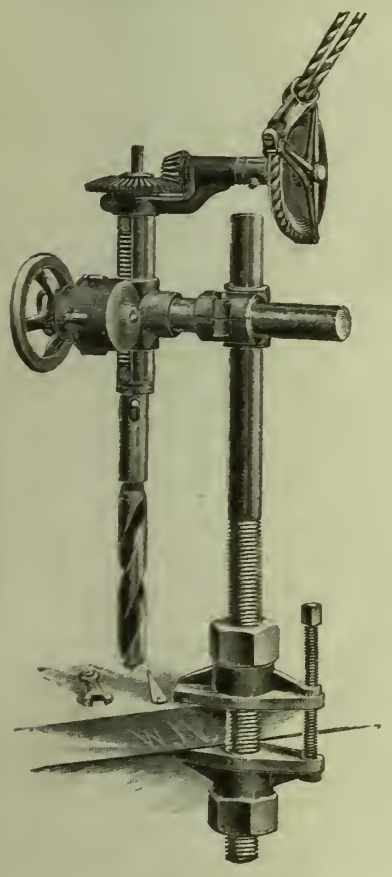


Fig. 1.

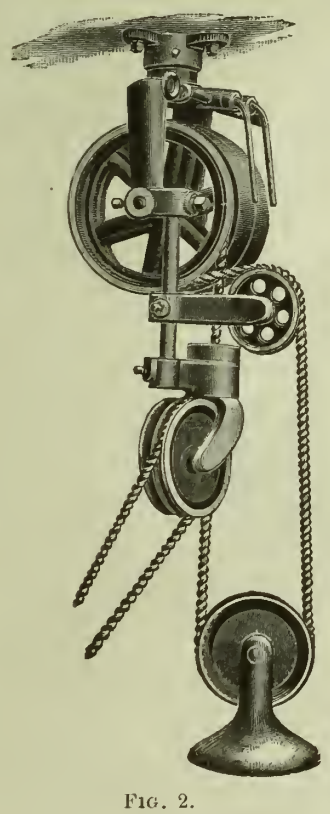


Fig. 2.

round belt on the driving pulley in any position it may assume. The guide pulleys also cause the rope to encircle nearly the whole of the periphery of the driving pulley. The more power there is applied, the closer the rope adheres to the groove, and it will not slip. Also, excessive strain, by weight or otherwise, on the rope to make it hug the groove of the pulley is unnecessary. The only strain required is that which is actually necessary to do the work. The driving pulley is 7 inches diameter, and is fitted for a ½-inch rope, and will furnish power enough to drive a 1-inch drill direct.

The universal counter-shaft, Fig. 2, used with the Colburn portable drilling machines, has two idle pulleys over which the rope runs to the drilling machine. These pulleys are held by a frame with a hollow stud through which the rope passes, allowing the idle pulleys to turn round and guide the rope to the drill in any direction, while the weighted idler takes up the slack rope, when drilling near to or from the counter-shaft, by its rise and fall. By inserting sections of rope, by hook couplings, any distance can be reached. One of the main features of the counter-shaft is the idle pulley up near the driving pulley. By this idle pulley, the rope, which usually encircles about half of the driving pulley, is made to encircle nearly the whole of the periphery of the driving pulley, thereby gaining power without excessive strain on the rope; it is next to impossible for the rope to slip in the groove. The upper part consists of a socket, which is first bolted to the ceiling, or any convenient timber, by three lag-screws. When the yoke containing the driving pulleys is inserted, and the set-screw in the socket turned up, the pulleys are lined up by the eye or guess until the belt is put on, when the yoke is slightly turned until the belt runs in the center of the loose pulley. No leveling or other lining is necessary. The pulleys are 10 inches diameter by 2½ inches face, and should make about 120 revolutions per minute.

The No. 5 size portable drill, Fig. 1, which weighs 112 pounds, is designed to drill up to 1½ inches diameter, and by the use of a boring bar, or countersink, has been known to bore holes up to 2¼ inches. The spindle has a feed of 6 inches, and for holes parallel with the post the feed can be made a foot or more by sliding the radial arm down on the post. The hole in the end of spindle is reamed with a No. 4 Morse taper reamer. The feeding arrangement is patent differential geared, has quick return and is entirely enclosed, taking up less room than a worm and gear, and can not be clogged by dirt or chips. Power can be applied direct to the spindle or geared as shown in the cut. The post is 36 inches long, and the radial arm is 12 inches long. The clamp feet open 10 inches between.

Further information may be obtained from the manufacturer, Albert L. Colburn, New Haven, Conn., who feels confident that his portable drilling machines "fill a gap which has long existed, namely, the want of a thoroughly portable drill which can be easily handled by one man, and one that can be readily applied

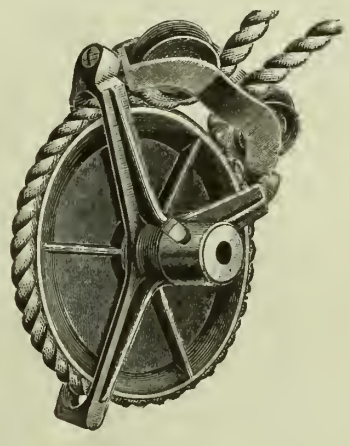


Fig. 3.

to the work without first drilling and tapping holes by other means, or using other devices than those directly attached to the drilling machine."

A THRILLING NIGHT CLIMB IN NORWAY.

I shall never forget that climb. We were hardly out of the road before we began to ascend, and I had shortly to stop for breath. My guide, however, if silent was thoughtful, and he soon caught my gait and knew when to pause. Up through the dusk we went, he guiding me, now by a word telling me how to step, or now turning to give me his hand to help me up a steep place, over a large rock, or around a bad angle. For a time we had heard the roar of the torrent as it boiled below us, but as we ascended it had gradually hushed, and we at length were in a region of profound silence. The night was cloudy, and as dark as it ever is in midsummer in that far northern latitude; but I knew that we were climbing along the edge of a precipice, on a narrow ledge of rock along the face of the cliff. The vast black wall above us rose sheer up, and I could feel rather than see that it went as sheer down, though my sight could not penetrate the darkness which filled the deep space below. We had been climbing about three hours when suddenly my guide stopped, and unwinding his rope from his waist, held it out to me. I obeyed his silent gesture, and bindidg it around my body gave him the end. He wrapped it about him, and then taking me by the arm, as if I had been a child, he led me slowly along the narrow ledge around the face of the wall, step by step, telling me where to place my feet, and waiting till they were firmly planted. I began now to understand why no one ever went "over the mountain" in the day. We were on a ledge nearly three thousand feet high. If it had not been for the strong, firm hold on my arm, I could not have stood it. As it was I dared not think. Suddenly we turned a sharp angle and found ourselves in a curious semicircular place, almost level, and fifty or sixty feet deep in the concave, as if a great piece had been gouged out of the mountain by the glacier which must once have been there.

"This is a curious place," I ventured to say.

"It is," said my guide. "It is the Devil's Seat. Men have died here."

His tone was almost fierce. I accepted his explanation silently. We passed the singular spot and once more were on the ledge, but it was not so narrow as it had been on the other side of the Devil's Seat, and in fifteen minutes we had crossed the summit and the path widened a little and began to descend.—From "Elsket," by Thomas Nelson Page, in August *Scribner* (Fiction number.)

THE TINPLATE INDUSTRY.

Long before the time of Julius Cæsar, tin was obtained from Britain. The most direct descendants of the ancient Britons, namely the Welsh, have to this day been the leaders of the work in the tin industry. Ex-Congressman Owen, as Chief of the United States Immigration Department, has opened the door wide for his blood relatives of Wales to "come over and help us" to make tin.

The recent disturbance in the tin market has been caused by the McKinley Act. The tin bosses of Wales precipitated matters by going to extremes. This is how the matter is presented in the *Mechanical World*, London, July 4:—

The lockout in the South Wales tin-plate works, which commenced last Monday, is the result of the attempt on the part of the Masters' Association to reduce the stock of tinplate which has been accumulated on the other side of the Atlantic during the last few months in anticipation of the coming into operation of the M'Kinley Tariff on the 1st inst. It is estimated that by stopping the South Wales works for 28 days, the stock of 1½ million boxes now in America will be decreased by about two-thirds. The merchants, however, may, in view of this action, advance the price so that the consumption will fall below the average, which is about one million boxes per month, in which case many of the makers appear ready to extend the period of stoppage still further. Of course such a line of action cannot fail to affect the position of the workmen very materially, nor will the effect be confined to the 20,000 workers in tinplate, but many of those engaged in the iron and steel trades, and about 4,000 colliers in the Swansea and Llanelly district, will suffer. Some of the tinplate manufacturers are endeavoring to diminish the suffering which would naturally result to men thrown out of employment for so long a period, by offering a portion of them work in carrying out necessary repairs at their manufactories and in the construction of reservoirs. But the men, as a whole, are very much incensed at the action of the makers in throwing them out for a whole month continuously. They argue that a stoppage of a week each month for four months would as effectually achieve the object the makers have in view, and there are already rumors of the men resenting their treatment in a practical manner. It is stated that during the month about 60 workers will go on a trip to America. It is probable that one object of this visit is to ascertain what facilities there are for transferring their knowledge and their services to capitalists in America. Should they as the result of their visit report favorably to their brethren in Wales, it is not at all unlikely that there may be so large an exodus from this country as to lead to a very great portion of a trade which has hitherto been almost entirely monopolised in Wales being transferred to America. Moreover, agents of American capitalists have for the past few weeks been in Wales obtaining information as to the best kind of machinery necessary in the economical production of tinplates, and as a result orders have already been delivered for the manufacture and delivery of some of the latest appliances.

The American Engineer.

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CONTENTS OF THIS NUMBER.

ENGINEERS generally will soon be required to be conversant with the working of electric light and electric power plants, as a contemporary remarks. Where licenses are granted to stationary engineers, electricity is not yet in it. But the demand for electric light, and especially for electric motors, is now so enormous that the small steam plants are bound to be crowded out. It is stated that one firm in New York is over 2,000 motors behind orders. That is to say, they have orders for that many more electric motors than they are about to deliver, and they have large forces of men making them night and day.

EDISON the Great has been awarded his rights in a court of justice, as the inventor of the modern incandescent lamp, and his patent is declared to cover the essential features of all varieties of these lamps as at present manufactured and used. It was argued, in effect, that Edison's patent covered more than he bargained for, so to speak. That is, he did not know the extent of the advantages of his device at the time he obtained it. As Judge Wallace said, that does not matter. Dr. Bell had but a faint idea as to what his telephone would do when it was patented. And even Edison, when he deviced an improvement on Bell's telephone, he stumbled on the phonograph unawares, as it were. At all events, we may expect lively music now among the manufacturers of incandescent lamps. They will have to pay the piper.

OUR VISITORS.

Among those who have favored us with a call, since the Supreme Convention, were J. J. Wilson, of Wahoo, Neb., the new supreme senior master mechanic; H. K. Stroud, of Hastings, Minn., new supreme inside sentinel; Thos. M. Thompson, of Detroit, Mich., the corresponding engineer of Onward Council, and also a number of the supreme board of trustees; and Chas. M. Anderson, of the Council Bluffs Council. All these are specially enthusiastic believers in the A. O. S. E. Bro. Wilson was immensely pleased with his trip east, and delighted with the proceedings of the Supreme Council. Bro. Stroud expressed himself much more so, and he was rejoicing on his way back to Minnesota. Bro. Thompson extended his vacation so as to visit some old and affectionate friends in Chicago, before returning home to Detroit. Bro. Anderson speaks well of Council Bluffs Council, aud especially of the David Gilbert Council on the other side of the muddy river. Among the "handful" of N. A. S. E. men in Omaha there are two or three "decent fellows," he says, and they are likely to join the ranks of the A. O. S. E. after September.

FEED WATER HEATED WITH LIVE STEAM.

"English engineers are much exercised over the discovery of a paradox in steam engineering, for which no satisfactory explanation seems to exist," says *Engineering News* (New York).

In another part of this issue we give an interesting article on this subject from a trans-Atlantic coutemporary, on which the *News* comments, and goes on to say:—"Feed-water heaters using exhaust steam or waste flue gases as a source of heat are common everywhere; but an inventive Englishman has hit upon the new idea of heating the feed water up to the full boiler temperature by live steam from the boiler before pumping it into the boiler. At first sight this looks like robbing Peter to pay Paul; and the inventor, indeed, claims to have had no expectation of increasing the fuel economy by his device, but only of reducing the internal strains on the boiler due to the entrance of cold iced water. But to the astonishment of all parties concerned, a marked and positive saving in fuel and a gain in the capacity of the boilers to furnish steam have followed the use of this heater. It now remains to find the reason why the heating surface of a boiler should absorb heat from a fire more rapidly when evaporating water at a temperature of over 300° than when heating water from ordinary feed water temperatures to the boiling point corresponding to the steam pressure. The explanation given by *The Engineer* is about as confused and unsatisfactory as its report of the tests made is clear and convincing. The point made as to keeping grease out of the boiler is a good one, but does not at all explain the tests recorded, in which the heater was put in and out of use at intervals of less than an hour. Our contemporary makes a worse error when it says: 'Each unit of heating surface will probably in a given time transmit about the same quantity of heat, whether the water in contact with it is 200° or 350° or even hotter.'

"Now, as a matter of fact, what the tests reported by *The Engineer* indisputably proved, was that a considerably greater quantity of heat was transmitted in a given time by the boiler heating surface when the feed water was heated by live steam from the boiler in the separate heater than when it was pumped directly into the boiler. It seems certain, too, that this increased efficiency of the heating surface was due to the fact that it was all at work generating steam instead of heating water to the boiling point in certain parts.

"If it be true that heating surface works more efficiently when evaporating water than when heating it, we have an explanation of certain facts hitherto little understood. The feed-water in a firebox boiler—the locomotive, for instance—is always pumped in at the front end, at the point farthest removed from the most efficient heating surface. The long time required to heat boilers up to working pressure and the strains and leaks which then occur may be due to the slower transmission of heat as well as to the other well-known cause, unequal expansion.

"Why heating surface should be more efficient when the water in contact with it is boiling, we can only conjecture. The most probable cause seems to be the motion which is set up as soon as the steam bubbles begin to form, violently agitating the water, and bringing fresh currents constantly against the hot plate. It is well known that the efficiency of heating surface is enormously increased when the water is moved over it at considerable velocity; and this may be the explanation of the seeming paradox described above."

So far, so good. If our expert contemporaries will bear in mind that a cousiderable quantity of electricity is often generated in steam boilers, as explained on the next couple of pages, they may perhaps be able to discover the true cause of the wonderful advantages, discovered unexpectedly, which arise from heating feed water with live steam.

MISTAKES WILL HAPPEN!

The editor of one of the Chicago papers recently tried to make a distinguished visitor happy, by giving a flattering report of an address delivered by the new arrival before a literary society whose guest he was. The remark was inserted in the report, by the editor himself, that Mr. So and So had spoken in a jocose manner for about fifteen minutes. Mark the word *jocose*. Next day the editor met Mr. So-and-So. The latter seemed offended at something. The editor enquired of a mutual friend whatever could the matter be. "Matter, indeed," said the friend, "many a man would challenge you to a duel for making such a remark as that in your report!"

"Good heavens," exclaimed the editor, "where is the paper?"

The paper was produced, and the editor hurriedly scanned the report in question, and, to his horror, he discovered that the report said Mr. So-and-So "had spoken in a jackass manner for about fifteen minutes." It was the *jackass* that caused the mischief.

The editor protested that he had written jocose iustead of jackass. And he hunted up the copy, and dismissed the proof reader who had passed that grave error.

Now, we refer to that incident simply to mollify the ridiculousness of a report in our last issue. In part of the chapter on The Supreme Council Meeting, page 37, we had written that the delegates and their friends "went to the Straight Line Engine Works, and their visit there was very much enjoyed, *and they were* especially *delighted with* the exhibition given by Prof. Sweet, which consisted of the taking of indicator cards while the engine was under *a pressure commencing at 60 lbs. and diminishing to nothing, and again commencing at nothing and rising to* 60 lbs. pressure." The words in *italics* were omitted in the report as it appeared in print, and thereby appeared as senseless as it was ridiculous.

The name of the Crystal Spring Brewery was also unaccountably left out of the subsequent paragraph. The "comp" may have been a malicious Prohibitionist. Anyway, he is now out of sight.

Daughters of Fulton.

During the A. O. S. E. Convention at Syracuse the Supreme Auxiliary of the Daughters of Fulton held a meeting one evening at the house of Mr. Jefferson Young, Jr., 211 East Castle St., Syracuse. There were about twenty delegates present, representing the three subordinate auxiliaries, namely, the Elmira of Bridgeport. Conn.; Sherman of Syracuse, and Cowles of Rochester, N. Y. The following officers of the Supreme Auxiliary were elected: Past matron, Mrs. Julia Young, of Syracuse: matron, Mrs. Elmira E. Deas, of Bridgeport; assistant matron, Mrs. Flora Wylie, of Bridgeport; secretary and treasurer, Miss May Deas, of Bridgeport; conductress, Mrs. Schmering, of Rochester; assistant conductress, Mrs. Latter, Syracuse; prelate, Mrs. Helen Eldridge, Rochester; inner guard, Mrs. Gleave, Syracuse; outer guard, Mrs. Rustin, Syracuse; supreme deputy, Miss Kate C. O. Young, Syracuse.

Several of the newly elected officers were installed the same evening. And a collation was served by Mr. aud Mrs. Young.

ELECTRICITY.

VII.—ELECTRICITY IN STEAM BOILERS.

Many of our readers may not be aware that electricity is generated in "large volumes" in their steam boilers. Yet such may be the case. We say *may be*, because there are such ingredients sometimes in the boiler that neutralize the conditions that produce electricity. Anyway, it is easy for every one in charge of a steam boiler to get up an electric current without a dynamo, or any of the now common electric apparatus; for the boiler itself is capable of generating the mysterious something which is usually designated electricity.

This was discovered accidentally, like many another wonder in physics. An engineer put his hand in a jet of steam, issuing from the valve setting of his boiler, and at the same time proceeded to adjust the weight of his valve lever with the other hand; and to his great surprise, a brilliant spark passed between his hand and the lever. From further observation it was ascertained that by placing one hand in the steam jet and the other hand (at the same time) on another part of the boiler a "circuit" of electric current was established.

This remarkable phenomenon was thoroughly investigated for several years. And at one time the making of steam boilers as electrical machines was a great "business." The boiler shown herewith stands on glass legs, for although a boiler set in the ordinary way produces electricity, it may be produced in a much larger volume when the boiler is insulated from mother earth. Yet, under certain conditions, better results are obtainable when there is a free connection between the boiler and the earth.

Steamboat boilers using saltless water, have often been ruined by electricity. During the war, much trouble resulted from eletricity in boilers and the engineers could not make out what was the matter until enlightened on this particular subject. It seems that electricity is developed most readily where grain rolls of the iron cross at right angles, such as at the union of the tubes and the tube heads. The electric current there set up eats the iron. Where surface condensers are used, which purify the water, the tubes soon leak. Where rain water is used, the boiler will be pitted within a year.

Mr. Stroud, the Deputy Supreme Chief of Minnesota, says the best protection against electricity in a boiler is a slight coating of salt. His friend, Bro. Callaway, of the Southwark Council, Philadelphia, is said to be well posted on this subject. We shall be glad to hear from him, and all others who have any information to impart.

How electricity is generated in a steam boiler is not definitely known. Faraday maintained it was generated by friction, while others hold that electricity is the result of chemical decomposition in the boiler. It may be the result of both friction and chemical decomposition combined. There is certainly a field for profitable electrical investigation here, right within the province of every steam engineer. And it affords the best opportunity, probably, for a great number of our readers to "get acquainted" with electricity in its generation. And we have much pleasure in now publishing as much information concerning the subject as we have been able to gather from the published statements of a learned lecturer who was intimately acquainted with Faraday, and from descriptions of the steam electric machines when they were manufactured.

Messrs. Watson and Lambert, of Newcastle, England, who constructed both the Polytechnic and the American machines, referred to in this chapter, went into the business pretty extensively, and constructed "hydro-electric machines" of various sizes, mounted on carriages so as to be readily moved about. A technical journalist of that day says that they constituted "very elegant pieces of electrical apparatus."

We have before us an engraving of one of the first that were made. The boiler is two feet six inches long, and one foot two inches in diameter. The fuel used was charcoal. When in good working order, a machine of the size mentioned would produce, according to the statement of the manufacturers, as much electricity as three 30-inch plate glass machines.

The boiler cut given herewith (Fig. 7) consists of a common steam boiler, with furnace, tubes, etc. The water gauge is plainly seen at the side, with the safety valve at the top. C is the tap turned on for the steam to reach the jets at A. A section of these jets, which are made of box wood, is shown at M. There is in each jet a bent piece of metal, to cause the steam to strike against the sides of the mouth piece, instead of coming out without interruption. The steam is also condensed suddenly as it reaches the jets by means of cold water in the reservoir B. The steam, under such conditions, issues from the jets highly charged with positive electricity which passes into the bunch of wires at P, the same being fixed to an insulated stand connected with a prime conductor, D. In the older cuts, the bunch of wires are shown further off, with a condensing pipe projected as far on the other side as the portion that reached to the bunch of wires. Two jets of steam were thus exhibited simultaneously issuing from the boiler at the same time but with opposite states of electricity—positive at the conductor end, and negative at the other. The iron steam pipes were enclosed in the condensing vessel, the lower part of which "contains water which nearly reaches the lower side of the steam pipes; from the latter are suspended filaments of cotton, which dip into the water, and by capillary action raise just sufficient to cause, by its action on the pipes, a condensation of the passing

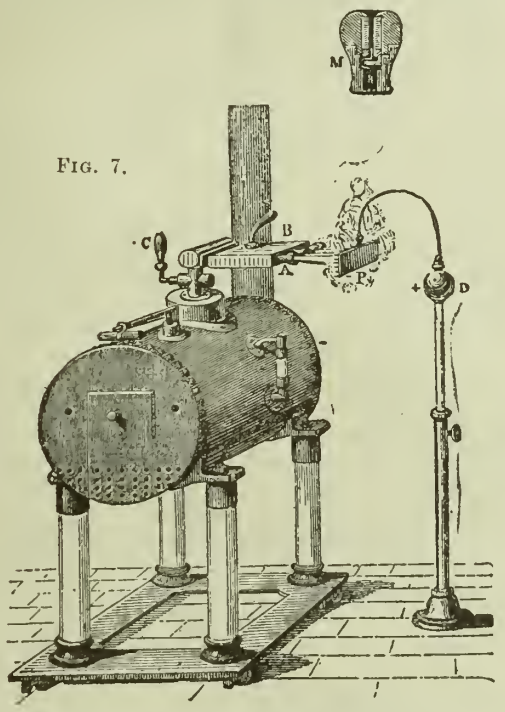


Fig. 7.

steam into the requisite quantity of water for rubbing against the jet." Here friction plays an important part evidently, however much there may be a chemical action (in the condensation of the steam.)

It should not be forgotten that electricity is produced from, or in, steam issuing in the ordinary way. Such an apparatus as that described only increases the quantity of electricity. The steam cloud of a locomotive engine contains electricity which is effected by its variable conditions.

Peltier (in *L' Institut*, Aug. 7, 1844) disputes the theory that friction is the cause of the development of electricity in the hydro-electric machines; he maintains that it is due to chemical decomposition. Below 230 degrees Fahr. Peltier obtained no sign of electricity. He found that while the head of a column of vapor was *positive* the tail was *negative*, the intermediate portions alternating from positive to negative according to the velocity of the train, the quantity of the prevailing vapors, the rapidity of the evaporation, and the state of the sky.

So long as the steam is perfectly dry, it does not seem to contain nor produce electricity. And when it contains the small globules of water, produced by condensation, there is no electricity if the entrained globules have a free and straight passage. And the fact that electricity is only produced when the condensed steam strikes against obstructions, goes a long way to support the friction theory.

Of late years Lyman's "exhaust head" is a device that has become familiar to steam engineers. It is placed, as every engineer knows, at the discharging end of an exhaust pipe. The steam is condensed more or less, by the time it reaches the exhaust head; and by striking against the obstructions, in the head, electricity is produced—by friction; and we would say that it is the electricity, thus produced, causes the chemical action which separates the globules of water from the steam, and the oil from the globules, both of which are held back by gravitation, and then dry steam only issues forth through the exhaust head.

We have entered into this matter somewhat minutely, because it is so closely associated with the every day work of a steam engineer.

And much may, probably, be learnt by experimenting in that particular field of investigation. And to enable our readers to judge for themselves, we give the following extensive details, gathered from the works of those who wrote on

ELECTRICITY OF EFFLUENT STEAM,

when that subject was discussed enthusiastically by the chief electricians of the time when steam boilers were in fashion as electrical machines.

Much of what we have already stated is repeated, only in the language of the original writers, and more fully, thus giving the opportunity for our readers to see whether our deductions, already given, are correct or not. For our information is derived from what we have read, and not from actual experiments. If any engineers should make experimental tests, we should be glad to have the results for publication.

Noad states the case as follows:

Under the head of *frictional* electricity must be included this very remarkable source of electrical development, which in the hands of Messrs. Faraday, Armstrong, Ibbetson and others, has led to the construction of electrical machines compared to which even the most powerful glass machines hitherto constructed are but as pigmies.

The first account we have of an observation on the electricity of a jet of steam while issuing from a boiler is contained in a letter addressed to Professor Faraday, by H. S. Armstrong(*Phil. Mag.*, Vol. XVII.)

It appears that the phenomenon was first noticed by the engineman entrusted with the care of a steam engine at Sedgehill, about six miles from Newcastle; it happened that the cement, by which the safety valve was secured to the boiler had a crack in it, and through this fissure a copious horizontal jet of steam continually issued. Soon after this took place, the engineman having one of his hands accidentally immersed in the issuing steam, presented the other to the lever of the valve, with the view of adjusting the weight, when he was greatly surprised at the appearance of a brilliant spark, which passed between the lever and his hand, and was accompanied by a violent wrench of his arms, wholly unlike what he had ever experienced before. The same effect was repeated when he attempted to touch any part of the boiler, or any iron work connected with it, provided his other hand was exposed to the steam. He next found that while he held one hand to the jet of steam, he communicated a shock to every person whom he touched with the other, whether such person was in contact with the boiler, or merely standing on the brick work which supported it; but that a person touching the boiler, received a much stronger shock than one who merely stood on the bricks.

In following up these experiments, Mr. Armstrong provided himself with a brass plate having a copper wire attached to it, which terminated in a round brass knob. When this plate was held in the steam, by means of an insulated handle, and the brass knob brought within about a quarter of an inch from the boiler, the number of sparks which passed in a minute was from sixty to seventy, and when the knob was advanced about one-sixteenth of an inch nearer to the boiler the stream of electricity became quite continuous. The greatest distance between the knob and the boiler, at which a spark would pass from one to the other, was fully an inch. A Florence flask, coated with brass filings, on both surfaces, was charged to such a degree with the sparks from the knob, as to cause a spontaneous discharge through the glass,—and several robust men received a severe shock from a small Leyden

jar charged by the same process. The strength of the sparks was quite as great when the knob was presented to any conductor communicating with the ground, as when it was held to the boiler.

A long and well-conducted series of experiments was made by Mr. Armstrong, on the electricity evolved under these peculiar circumstances. By standing on an insulated stool, and holding with one hand a light iron rod immediately above the safety-valve of a locomotive engine, while the steam was freely escaping, and then advancing the other hand toward any conducting body, he obtained sparks of an inch in length; when the rod was held five or six feet above the valve, the length of the sparks was two inches; and when a bunch of pointed wires, attached to the rod, was held points downwards in the issuing steam, sparks *four inches long* were drawn from a round knob, on the opposite extremity of the iron rod. On insulating the boiler large and brilliant *negative* sparks an inch long were drawn from it—the electricity of the steam being positive.

A *small* boiler was constructed by Mr. Armstrong—it was arranged on a stove which was insulated; when the rate of evaporation was about a gallon in an hour, and the pressure in the boiler 100 lbs. on the square inch, by connecting the knob of a Leyden phial with the boiler or stove, he was able to give it a charge, and he found that electricity could be collected in much greater abundance from the evaporating vessel than from the issuing steam. The electricity of the steam was generally positive, that of the insulated boiler being negative; occasionally, however, these conditions were reversed, and after the boiler had been in use for some time, positive electricity rarely appeared in the jet, even when circumstances were most favorable to its development. No alteration was effected by washing out the boiler with water, but when it was washed out with solution of *potash* or *soda*, the *positive* condition of the steam jet was restored, and by dissolving a little potash in the water from which the steam was generated, the quantity of electricity was amazingly increased; on the other hand, when a small quantity of *nitric acid* or *nitrate of copper*, was added to the water, the electricity of the steam became negative.

Subsequent experiments led Mr. Armstrong to the conclusion that the excitation of electricity takes place at the point where the steam is subjected to friction; and, in a paper subsequently read before the Royal Society by Professor Faraday, it was shown that the steam itself has nothing to do with the phenomenon. By means of a suitable apparatus, Faraday found that electricity is never excited by the passage of pure steam, and is manifested only when water is at the same time present; and hence he concludes that it is altogether the effect of the friction of globules of water against the sides of the opening, or against the substances opposed to its passage, as the water is rapidly moved onwards by the current of steam. Accordingly, it was found to be increased in quantity by increasing the pressure and impelling force of the steam. The immediate effect of this friction was, in all cases, to render the steam or water positive, and the solids, of whatever nature they might be, negative. In certain circumstances, however, as when a wire is placed in a current of steam, at some distance from the orifice whence it has issued, the solid exhibits the positive electricity already acquired by the steam, and of which it is then merely the recipient and the conductor. In like manner the result may be greatly modified by the shape, the nature, and the temperature of the passage through which the steam is forced. Heat, by preventing the condensation of the steam into water, likewise prevents the evolution of electricity, which again speedily appears by cooling the passages, so as to restore the water which is necessary for the production of that effect. The phenomena of the evolution of electricity, in these circumstances, are dependent also on the quality of the fluid in motion, more especially in relation to its conducting power. Water will not excite electricity unless it be pure; the addition of any soluble salt or acid, even in minute quantity is sufficient to destroy this property. The addition of oil of turpentine, on the other hand, occasions the development of electricity of an opposite kind to that which is excited by water; and this Faraday explains, by the particles and minute globules of the water having each received a coating of oil, in the form of a thin film, so that the friction takes place only between that external film and the solids, along the surface of which the globules are carried. A similar, but more permanent effect is produced by the presence of olive oil, which is not, like oil of turpentine, subject to rapid dissipation. Similar results were obtained when a stream of compressed air was substituted for steam in these experiments. When moisture was present, the solid exhibited negative, and the stream of air positive electricity; but when the air was perfectly dry, no electricity of any kind was apparent.

Mr. Armstrong subsequently (*Phil. Mag.*, vol. XXII, p. 1,) confirmed the conclusion, that the excitation of electricity takes place at the point where the steam is subjected to friction, and described several improvements in his apparatus by which the energy of the effects was amazingly increased. By means of a boiler furnished with a stopcock and a discharging jet of peculiar construction, he produced effects upwards of seven times greater than those from a plate electrical machine of three feet in diameter, worked at the rate of seventy revolutions per minute. This boiler was a wrought iron cylinder, with rounded ends, and measured three feet six inches in length, and one foot six inches in diameter. It rested on an iron frame, containing the fire, and the whole apparatus was supported on glass legs to insulate it. It was found much more convenient and effectual to collect electricity from the boiler than from the steam cloud, but, in order to obtain the highest effect from the boiler, the electricity of the steam must be carried to the earth by means of proper conductors.

In Mr. Pattinson's experiments on one of the locomotive engines belonging to the Newcastle and Carlisle Railway, sparks *four inches* long were given off from the person of an individual standing on an insulating stool, and holding a copper rod, terminated by sharp-pointed wires, in the current of steam, blowing forcibly out of the safety-valve at a pressure of 52 lbs. per inch. The electricity was ascertained to be positive. It is certainly, as Mr. Pattinson observes, a novel and curious light in which to view the splendid locomotive engine in its rapid passage along the railway line, viz., that of an enormous electrical machine—the steam analogous to the glass plate of an ordinary machine, and the boiler to the rubber; while torrents of electricity might continually be collected, by properly disposing conductors in the escaping steam.

Shortly after these experiments were made the directors of the Polytechnic Institution determined on constructing a machine on a large scale for the purpose of producing electricity by the escape of steam; and under the superintendence of Mr. Armstong, assisted by Captain Ibbetson, the "Hydro-Electric Machine" was finished and placed in the theatre of the institution; where by its extraordinary power it soon excited the astonishment of all who beheld it. The machine consists of a cylindrical shaped boiler, similar in form to a steam engine boiler, constructed of iron plate § inch-thick; its extreme length is 7 feet 6 inches, 1 foot of which being occupied by the smoke chamber, makes the actual length of the boiler only 6 feet 6 inches; its diameter is 3 feet 6 inches. The furnace and ash-hole are both within the boiler; when it is required entirely to exclude the light a metal screen is readily placed over these; by the side of the door is the water-gauge and feed-valve. On the top of the boiler, and running nearly its entire length, are forty-six bent iron tubes, terminating in jets having peculiarly shaped apertures, and formed of partridge wood, which experience has shown Mr. Armstrong to be the best for the purpose; from these the steam issues—the tubes spring from one common pipe, which is divided in the middle and communicates with the boiler by two elbows; by this contrivance the steam is admitted either to the whole or part of the tubes, the steam being shut off or admitted by raising or lowering the two lever handles placed in the front of the boiler. Between the two elbows is placed the safety-valve for regulating the pressure, and outside them on one side is a cap covering a jet employed for illustrating a certain mechanical action of a jet of steam, and on the other a loaded valve for liberating the steam when approaching its maximum degree of pressure. At the further extremity of the boiler is the funnel pipe or chimney, so contrived that, by the aid of pulleys and a balance weight, the upper part can be raised and made to slide into itself (similar to a telescope), so as to leave the boiler entirely insulated. To prevent as much as possible the radiation of heat, the boiler is cased in wood, and the whole is supported on six stout glass legs 3½ inches diameter, and 3 feet long. In front of the jets, and covering the flue for conveying away the steam, is placed a long zinc box, in which are fixed four rows of metallic points for the purpose of collecting the electricity from the ejected vapor, and thus prevent its returning to restore the equilibrium of the boiler. The box is so contrived that it can be drawn out or in, so as to bring the points nearer to or further from the jets of steam; the mouth or opening can also be rendered wider or narrower; by these contrivances the power and intensity of the spark is greatly modified. A ball and a socket-joint, furnished with a long conducting rod, has been added to the machine, so that by its aid the electricity can be conveyed to the different pieces of apparatus used to exhibit various phenomena. The pressure at which the machine is usually worked is 60 lbs. on the square inch. As it is now fully established that the electricity of the hydro-electric machine is occasioned by the friction of the particles of water, the latter may be regarded as the glass plate of the common electrical machine, the partridge wood as the rubber, and the steam as the rubbing power. The electricity produced by this engine is not so remarkable for its high intensity as for its enormous quantity. The maximum spark obtained by Mr. Armstrong in the open air was 22 inches; the extreme length under present circumstances has been 12 to 14 inches; but the large battery belonging to the Polytechnic Institution, exposing nearly 80 feet of coated glass which, under favorable circumstances, was charged by the large plate machine 7 feet in diameter in about 50 seconds, is commonly charged by the hydro-electric engine in 6 or 8 seconds. The sparks which pass between the boiler and a conductor are exceedingly dense in appearance and, especially when short, more resemble the discharge from a coated surface than from a prime conductor. They not only ignite gunpowder, but even inflame paper and wood shavings when placed in their course between two points.

In the 151st number of the *Philosophical Magazine*, a series of electrolytic experiments made with this machine are described by Mr. Armstrong; true polar decomposition of water was effected in the clearest and most decisive manner, not only in one tube, but in ten different vessels arranged in series, and filled respectively with distilled water, water acidified with sulphuric acid, solution of sulphate of soda, tinged blue and red, solution of sulphate of magnesia, &c., &c., and the gases were obtained in sufficient quantities for examination.

The following curious experiments are likewise described:—two glass vessels containing pure water were connected together by means of wet cotton; on causing the electric current to pass through the glasses, the water rose above its original level in the vessel containing the negative pole, and subsided below it in that which contained the positive pole, indicating the transmission of water in the direction of a current flowing from the positive to the negative wire.

Two wine glasses were filled nearly to the edge with distilled water, and placed about 4-10ths of an inch from each other, being connected together by a wet silk thread of sufficient length to allow a portion of it to be coiled up in each glass. The negative wire, or that which communicated with the boiler, was inserted in one glass, and the positive wire, or that which communicated with the ground, was placed in the other. The machine being then put in action, the following singular effects presented themselves:—

1st. A slender column of water, inclosing the silk thread in its centre, was instantly formed between the two glasses, and the silk thread began to move from the negative toward the positive pole, and was quickly all drawn over and deposited in the positive glass.

2nd. The column of water after this continued for a few seconds suspended between the glasses as before, but without the support of the thread, and

when it broke the electricity passed in sparks.

3rd. When one end of the silk thread was made fast in the negative glass the water diminished in the positive glass, and increased in the negative one, showing apparently that the motion of the thread, when free to move, was in the reverse direction of the current of water.

4th. By scattering some particles of dust upon the surface of the water, it was soon perceived by their motions there were two opposite currents passing between the glasses, which, judging from the action upon the silk thread in the centres of the column, as well as from other less striking indications, were concluded to be *concentric*, the inner one flowing from negative to positive, and the outer one from positive to negative. Sometimes that which was assumed to be the outer current was not carried over into the negative glass, but trickled down outside of the positive one, and then the water, instead of accumulating as before in the negative glass, diminished both in it and in the positive glass.

5th. After many unsuccessful attempts Mr. Armstrong succeeded in causing the water to pass between the glasses, without the intervention of a thread for a period of several minutes, at the end of which time he could not perceive that any material variation had taken place in the quantity of water contained in either glass. It appeared, therefore, that the two currents were *nearly*, if not *exactly* equal, while the inner one was not retarded by the friction of the thread. Mr. Armstrong likewise succeeded in coating a small silver coin with copper, in deflecting the needle of a galvanometer, between 20° and 30°, and in making an electro-magnet by means of the electricity from this novel machine.

Extraordinary as is the power of the Polytechnic machine, it was afterwards entirely eclipsed by a similar apparatus constructed at Newcastle under the direction of Mr. Armstrong, and sent out to the United States of America. In the arrangement of this machine, the boiler of which is not larger than that at the Polytechnic Institution, Mr. Armstrong introduced certain improvements suggested by the working of the latter, and which had reference to those parts of the apparatus more immediately concerned in the production of the electricity, viz., "*the escape apertures and the condensing pipes.*" It was found to be a matter of extreme nicety so to adjust the quantity of water deposited in the condensing pipes as to obtain the maximum excitation of electricity. If on the one hand there be an excess of water, then two results will ensue, each tending to lessen the electricity produced. 1st, the mean density of the issuing current of steam and water is increased, which causes the velocity of efflux and consequent energy of the friction to be diminished; and 2nd, the ejected steam cloud is rendered so good a conductor by the excess of moistnre that a large proportion of the electricity manifested in the cloud retrocedes to the boiler, and neutralizes a corresponding proportion of the opposite element. On the other hand, if the quantity of water be too small, then, although each particle of water may be excited to the fullest extent, the effect is rendered deficient in consequence of the insufficient number of aqueous particles which undergo excitation. In the Polytechnic arrangement the condensation of the steam in the tubes is effected by contact of the external air, and when the density of the steam in the boiler is diminished rapidly they do not cool down with sufficient rapidity to condense the requisite quantity of water. To remedy this defect in the American machine, Mr. Armstrong adopted a method of condensing by the application of cold water; a number of cotton threads were suspended from each condensing pipe into a trough of water from which by capillary attraction just as much water was lifted as was required for the cooling of the pipe, since it was easy by increasing or diminishing the quantity of cotton to increase or diminish the supply of cold water; and this method of keeping down the temperature proved so effective that two or three times the number of jets that were used could now be employed. The number in the American machine was 140, ranged in two horizontal rows, one above the other, on the same side of the machine. The sparks obtained, though not longer than those upon the London machine when it stood in the open air, succeeded each other *with three or four times* the rapidity, and even under unfavorable circumstances charged a Leyden battery consisting of thirty-six jars, containing thirty-three feet of coated surface, to the utmost degree that the battery would bear, upwards of sixty times in a minute, being equivalent to charging nearly 2,000 feet of coated surface in one minute, which is at least *twenty times* greater than the utmost effect that could be obtained from the largest glass electrical machine ever constructed.

BOILER EXPLOSIONS.

The worst explosion of a boiler that has occurred recently was the bursting of the boiler of No. 12 engine in the Burlington and Missouri Railroad round house, on Thursday evening last week. No. 12 is one of the oldest engines on the road. It had recently undergone thorough repairs, and was considered as good as new almost. It was standing in its stall, ready to go out; and five minutes before the explosion, the guage registered only 90 lbs. pressure, it is claimed. It exploded, however, killing two men outright, fatally injuring another, and doing much damage. The locomotive was literally torn into shreads.

The walls and roof covering six-stalls of the twenty-stall round-house were blown out, and within the building are piled up immense heaps of brick and timbers. Two locomotives standing on either side of No. 12 are badly damaged. The steam dome of No. 12 was blown up into the air and hurled outside of the round-house. A portion of the boiler was blown out through the roof of the first section.

William Rasmussen, an engineer, had just brought his engine into the stall adjacent to No. 12, and stopped to speak to Charles Hasemeyer, the fireman. He had just started away when the explosion occurred, was struck in the left hip with a piece of flying debris and knocked into the pit. Hasemeyer was found in the gangway pinioned against the coal gate, with a board driven through his body just below the breast. His head was terribly cut and his face and side burned.

John Hardruba, an engine wiper, was found beneath a pile of debris with a hole in his head, from which the brains oozed. He was otherwise terribly cut and bruised, and life was extinct. Frank Maurer, another wiper, when found was alive, although his left ear had been torn off, his head badly mashed, and he was otherwise injured. Charles Miller, the foreman, was also badly bruised.

Night Hostler E. B. Thrall was in the same section, and he was blown over the boiler-head of a locomotive, but was not injured, with the exception of some bruises.

On the afternoon of the same day, the boiler at Lee's saw mill, at Nineveh, N. Y., exploded, killing James Shaw, Frederick Wheeler, and another man. The building was blown to atoms, and the bodies of the three men were torn to pieces.

At the Bridgeport pumping works, Chicago, there was recently a "suppressed" explosion, that is the report of it was suppressed. As far as can be ascertained, it occurred during the small hours of Monday morning, July 21. And judging from the ruins, it must have been a terrible explosion.

When enquiry about the matter was made of the chief engineer, Wm. J. Culliton, he declared: "There's nothing in it. The bottom of the boiler dropped out, and the building collapsed. That's all there is to it. I don't see why anything should be published about this. No one was killed. I saw the steam gauge at 2 o'clock, and it indicated only 60 lbs. pressure. As soon as I reached the office, about 2:15 the explosion occurred. The firemen were at the door taking a little fresh air, I suppose. No one was killed. The old boiler was played out; that is all. It had been in service night and day for nine years, which is equal to 18 years ordinary service. The exact cause of the explosion is 'unexplainable.' I am over 30 years old, and have seen 20 explosions in my time, not one of which was ever satisfactorily explained!"

If the above statement is true, Chief Engineer Culliton has seen his full share of boiler explosions. And it is about time that he began to understand the causes of boilers being "played out" in that fashion, and remove the causes, or else he may come across one explosion too many before long.

There are two boiler houses at the Bridgeport pumping works, or at least there were two until the one "collapsed" when the bottom of the boiler "dropped out." One is on the north bank of the Bridgeport Canal, and the one destroyed was on the south bank. There were four boilers in each.

CORRESPONDENCE.

Frank R. Streeper Expelled.

To the Officers and Members of the A. O. of S. E.:

Sirs and Brothers:—You are hereby notified that Frank R. Streeper has been expelled from Southwark Council for having allowed himself to become in arrears for dues after obtaining a position through the influence of the A. O. of S. E. Yours fraternally, C. P. Williams, Cor. Engr.

Jas. McKenzy Re-instated.

To the Editor of the American Engineer:

Sir:—At our regular meeting, July 24, 1891, Brother James McKenzy came up and paid his dues and was re-instated. He said that it was his neglect, and not intentional dereliction. Thereupon the council apologized.

Prof. John E. Sweet was present and gave a lecture on the indicator and card, whereby the boys received some useful information.

If any of the sister councils wish to visit us, and hear the Professor lecture, we would be pleased to have them.

The Professor will oblige the council on any question pertaining to steam, when he can come.

W. A. Gleave, Cor. Engineer.

Slide Valve vs. Corliss.

To the Editor of the American Engineer:

Sir:—Old Slide Valve says I dodge, which I do not. He wanted facts, and I gave them, and if there was any favor shown, it was given to the slide valve. The coal saved on the Corliss was even greater than I gave it, as I found out later. He is under the impression that I run a Corliss, which is a mistake; one of my engines is a 10x15 vertical, the other 16x36, both slide valve; the larger engine has an automatic cut-off governor on it, and runs 76 turns per minute; the main valve has sixteen parts, and the cut-off valve the same number. It is called the Goodwin cut-off, and is made only in Philadelphia. But this is not the issue at present. With my cut-off I am at least 10 per cent behind the Corliss, but am 20 per cent ahead of throttled engines. My cut-off is all right; but the percentage of clearance to the size of cylinder is not. Now, Mr. Slide Valve, let us look into your cylinder, and see what we will find: 18x36 parts 12″ long, 12″ deep, 1″ wide; 144 square inches; both ends 288″; rev. per min., 86; 33,768 square in. of steam per minute; 33,768x60 equal 2,026,080 in. per hour. 10 hrs. per day, 2,026,080x10 equal 20,260,800 per day. Divided by 1,728, gives 11,725 cubic feet of steam per day, which has to be filled before the engine does work; 100 lbs. steam volume for that pressure. Two hundred and fifty-nine into 11,725 gives 45 cubic feet of water per day. Sixty-two and a half pounds to the foot gives 2,812 lbs. of water per day, allowing 9 lbs. of water evaporated to 1 lb. of coal; 312 lbs. coal per day to fill clearance, which a Corliss engine does not have; that is nearly one ton per week.

Why don't Old Slide Valve give us a card? He tells us he gets 60 M. E. P., but he don't tell us at what pressure he let it out of his cylinder, or what he loses from boiler to engine. Does he mean to tell us that 60 M. E. P. is an economical load to carry? I would advise him to put 50 turns more on his engine, and bring down his M. E. P. to 40 lbs.; then possibly he might save another ton of coal per day. He tells us that the other engineers run her 40 revs. and carry 60 lb. steam. Allowing 55 lbs. at the engine, and cut off at half stroke would give a M. E. P. of 35 lbs. Area of piston 254,″240″ travel of piston, 60,960 by 35 gives 2,133,600x33,000 64½ h. p. which a good Corliss would give on one ton per day. He tells us he saves 1½ ton per day. How much did his old slide valve burn, now he speeds her up to 86 revs., carrying 100 lbs. steam, and getting 60 lbs. M. E. P.? Area of piston 254″, 316″ travel per minute 131,064x60 M. E. P. 7,863,840x33,000 238 h. p. and over. Where does he get the 174 h. p. over the other engineer? Have they put this

extra load on the engine, and does he mean to tell us that he drives this extra load and saves all the coal he speaks of? He is a genius, and I would like to shake hands with him.

No, Mr. Slide Valve, I don't bother my brains about valve gear; I get it right, and let it alone for two or three years. I had one for four years, and never spent one minute on it, outside of regular working hours. How many have tried to beat it, but have failed? How many slide valve engine builders have commenced to build Corliss, and why? Because they had to do it or shut up shop. The men that pay the coal bills want to have the old throttle engine; hundreds of them you can buy for most nothing. But how quick a second hand Corliss is bought. There is not any on the market, it is the most practical balanced valve, as forty years' use has proved it to be.

No, Mr. Slide Valve, the governor is all right, as our fine spinning and weaving mills will testify. Where regulation must be perfect, it only wants a Corliss engine.

Six years ago, in this city, there was not a Corliss engine built here; now there are five firms building Corliss engines. Comment is unnecessary.

Recording Engineer, Kensington Council No. 3, of Pa.

In Memoriam.

Geo. E. Bradbury.

Omaha, Neb., July 20, 1891.

We are called upon to perform the painful duty of recording the death of our brother Geo. E. Bradbury, who accidentally met his death while at his post of duty in the Paxton Hotel of this city Monday evening, July 13, 1891.

He was caught in the elevator shaft while examining the machinery, and his life was crushed out.

Bro. Bradbury was thirty-two years old at the time of his death. He leaves a wife to mourn his untimely death, who was absent visiting in California.

Though separated from those who were dear to him, yet he was surrounded in the last hours of his life by a band of brothers whose kindness and love went out in sympathy toward him, and true to their pledge took charge of his remains and tenderly laid them to rest in Forest Lawn Cemetery, July 19, 1891, with appropriate funeral services. Rev. John Williams of St. Barnabas' church conducted the funeral services, which were very impressive, paying a tender tribute to the dead.

The funeral cortege was large, there being about one hundred and fifty engineers present, besides a large number of friends; the brothers from Council Bluffs assisting, and the N. A. S. E. kindly accepting our invitation to be present with us at the last sad parting from our brother, who has penetrated the veil of eternity and entered into the immortal shore.

The floral tributes were many and beautiful; among them was a miniature wheel composed of cut roses, a break in the wheel, with the loss of a spoke was emblematic of the loss of our brother. Yes, the wheel of life is broken, and his toil is over, but in that beautiful land over there, may he meet the Supreme Chief of the Universe, who will say: "Well done thou good and faithful servant, come up higher."

The following resolutions were passed by the Council, spread upon the minutes, and published in the city papers.

Whereas, It has pleased the Supreme Chief of the Universe to remove from our midst, to the Supreme Council above, our beloved brother Geo. E. Bradbury; be it

Resolved, That this Council has lost a faithful brother, and the city a competent engineer; and be it further

Resolved, That a communication be sent to the bereaved wife of our deceased brother, extending our heart-felt sympathy in this her sad bereavement. Also

Resolved, That these resolutions appear in the minutes of the Council and a copy be sent to The American Engineer, and the city papers.

Arthur Pender,
Wm. J. Crosier,
Chas. E. Weeks,
} Committee.

The following resolutions were passed by the N. A. S. E. of this city, and presented to the A. O. S. E. as a token of the sympathy they had with us in our sorrow.

To the officers and members of No. 2, of Nebraska A. O. S. E.

Whereas, Mr. Geo. Bradbury, a stationary engineer of this city, was crushed to death in an elevator shaft while in discharge of his duty, and

Whereas, Mr. Geo. Bradbury was a member of No. 2 of Nebraska A. O. S. E., a fellow citizen and a co-worker, therefore be it

Resolved, That we the officers and members of No. 1 of Nebraska N. A. S. E. do hereby extend, to the officers and members of No. 2 of Nebraska A. O. S. E., our condolence and sympathy for the loss of their brother; and be it

Resolved, That all of our members, not on duty, attend the funeral of deceased; and be it

Resolved, That a copy of these resolutions be presented to No. 2 of Nebraska A. O. S. E., and be spread on the minutes of this Association.

James Anderson,
T. J. Collins,
W. B. Austin,
} Committee.

Deputy Supreme Chief Appointments.

To whom it may concern:

Be it known by these presents: That by virtue of the authority vested in me by the Supreme Council, American Order of Steam Engineers, I do hereby appoint the following Brothers to be Deputy Supreme Chief Engineers for the states named, and they must be respected and obeyed accordingly.

(Signed,) Jefferson Young, Jr.,
Supreme Chief Engineer.

California, John Oswald, 517 Oak St., San Francisco.

Connecticut, Stillman Light, 34 Fairfield Ave., Danbury.

Illinois, (North Dist.)

Illinois, (South Dist.)

Indiana, (North Dist.), Jefferson Malloy, New Albany.

Indiana, (South Dist.), G. W. Rose, care, Blount Wagon Co., Evansville.

Iowa, (North Dist.), Ralph C. Smith, Leeds.

Iowa, (South Dist.), H. P. Midge, Council Bluffs.

Kansas, A. B. Fell, Kingman.

Massachusetts, Chas. E. Jacks, rear, 22 Chauncey St., Boston.

Michigan, Robert Hunter, Ann Arbor.

Minnesota, (East Dist.), H. K. Stroud, Hastings.

Missouri, (East Dist.), E. B. Hill, 814 Salisbury St., St. Louis.

Missouri, (West Dist.), W. A. Sullivan, St. Joseph.

Nebraska, R. H. Cooper, 13th and Farnham Sts., Omaha.

New Hampshire, Alex. Taggart, care, Amoskeag Mf'g Co., Manchester.

New Jersey, Joseph S. Wheaton, 456 South 3rd St., Camden.

New York, John Schmering, 24 Cady St., Rochester.

North Carolina, John W. Shaw, Raleigh.

Ohio, A. W. Southwell, American House, Cleveland.

Oregon, Henry Coates 294 Washington St., Portland.

Pennsylvania, James Lightfoot, 2153 Church St., Philadelphia.

South Carolina, Geo. H. Gardner, Spartansburg.

South Dakota, Fred L. Burdick, Watertown.

Washington, Herbert Leigh, Tacoma.

Wisconsin, John Halsted, Sheboygan.

Grand Council of Massachusetts.

The officers of the Grand Council of the State of Massachusetts were installed on the evening of July 10th, by Deputy Supreme Chief Chas. E. Jacks, as follows:—

Grand Chief Engineer, Wm. V. Warfield.
Grand First Assistant, H. G. Bean.
Grand Recording Engineer, J. T. Dodge.
Grand Corresponding Engineer, I. H. F. Smith.
Grand Treasurer, W. D. Carr.
Grand Senior Master Mechanic, Thos. Ditchett.
Grand Junior Master Mechanic, E. E. Humphrey.
Grand Inside Sentinel, E. N. Beals.
Grand Outside Sentinel, H. M. West.
Grand Chaplain, J. H. Blanchard.

After the installation, Bro. Jacks made a short, well-worded address, encouraging the "boys" to do their utmost for the Good of the Order.

Southwark Council, No. 4, Pa.

On Monday, week before last, Grand Chief Engineer H. G. Connor, of Pennsylvania, installed the following officers of Southwark Council, No. 4, Pa., at their council chamber, in the American Mechanics' hall, Philadelphia, namely:

J. Hamilton Myers, chief engineer.
Frank Warner, first assistant.
F. R. Moore, recording engineer.
C. P. Williams, corresponding engineer.
Chas. Wilson, financial engineer.
Wm. Darnells, treasurer.
Wm. C. Simmons, senior master mechanic.
J. J. McMenemes, junior master mechanic.
Alexander Palmer, inside sentinel.
Henry Beadling, outside sentinel.
J. McKinnez, chaplain.
L. J. Callaway and Wm. Small, trustees.

David Gilbert Council, No. 2. Neb.

At the regular meeting of David Gilbert Council, No. 2, A. O. S. E., July 7th, the following officers, after being duly elected, were installed:

Past Chief, Arthur Pender.
Junior Ex-Chief, R. H. Cooper.
Chief Engineer, D. W. Gilbert.
First Asst. Engineer, Wm. Harris.
Recording Engineer, Chas. E. Weeks.
Corresponding Engineer, John L. Miller.
Financial Engineer, Chas. Brink.
Treasurer Engineer, Swan Benson.
Chaplain, R. Yocum.
Senior Master Mechanic, H. I. Garlick.
Junior Master Mechanic, D. B. Schurig.
Inside Sentinel, Frank Gotham.
Outside sentinel, D. J. Wycoff.

Bro. J. J. Wilson, Supreme Deputy, was present and conducted the ceremony of installation.

David Gilbert Council is in a flourishing condition. The number of our members are constantly increasing. The brothers are all interested in the growth and prosperity of our noble Order, and with a united effort and good cheer, tempered with brotherly love, all along the line, will put the A. O. S. E. to the front in Omaha.

John L. Miller, C. E.

The Park Council, No. 8, Pa.

To whom it may concern: This is to certify that on the 2nd day of June, 1891, the Hon. H. G. Connor, grand chief engineer of the state of Pennsylvania, re-instated Park Council, No. 8, of Pa., at Philadelphia, to all the rights and privileges of the American Order of Steam Engineers. And therefore all the boys of the Order are exhorted to extend the right hand of fellowship to the members of Park Council, and assist them in building up said council to its former prosperity.

The following officers were elected and duly installed July 7, 1891, to serve for the term of six months:

Chief engineer, Wm. H. Lehman.
First assistant engineer, Jas. J. Murphy.
Recording engineer, Dallas Reese.
Corresponding engineer, John H. Grimes.
Financial engineer, E. M. C. Smith.
Treasurer engineer, R. G. Black.
Chaplain, John A. Barr.
Senior master mechanic, Michael Ford.
Junior master mechanic, Herbert A. Hess.
Inside sentinel, E. A. Mallon.
Outside sentinel, P. R. Bousman.
Trustees, W. H. Legman, W. P Dennis and John H. Dennison.

The Harry Hohn Fund.

Bro. Franklin R. Moore, 727 Filbert Street, Philadelphia, the treasurer of the Harry Hohn Fund, states that he has received eleven dollars ($11.00) from Brother George H. Kellogg, of Syracuse, N. Y., for the said fund.

JAMES C. WATT RECOVERED.

The corresponding engineer of Geneva Council, A. O. S. E., New York, writes to say that Bro. James C. Watt, engineer in the Geneva carriage works, who had his finger cut off some time ago, at the second joint, has now recovered. It may be said he never lost any time, but kept the wheel turning. He is a Scotchman, and a member of Geneva Council, No. 13, N. Y

HEATING FEED-WATER WITH LIVE STEAM.*

Two or three years ago Mr. John Kirkaldy, of West India Dock road, invented an apparatus for heating feed-water with what Americans have not inaptly called "live" steam—that is to say, steam which, drawn fresh from a boiler, has done no work. It is well known that when the fires are lighted in a marine boiler, and for some hours afterward, the bottom water remains cold. The boiler is thereby exposed to very severe strains, which it is most desirable to avoid. Mr. Kirkaldy's first idea was to heat up the water with steam from the donkey boiler. The result obtained was satisfactory. The primitive idea underwent a process of development, and finally a heater was devised through which all the feed-water was pumped and raised to a high temperature by steam drawn from the boiler. There was no intention of saving fuel. The sole object had in view was to do away with the mischief that every marine engineer knows is caused by pumping cold water into the boilers of a ship. With hot feed-water, leaky tube ends and riveted seams no longer vex the soul of the engineer.

It was found that the Kirkaldy heater answered its purpose perfectly, but an entirely unexpected result, also followed on the use of heater. Coal bills were reduced and boilers which were before short of steam now made it in abundance. Such was the statement made to us and we received it with incredulity. But report after report, log after log, all told the same story, and the fact that shipping firms beginning with one heater on trial, went on and ordered others, was a fact not to be gainsaid. On the face of affairs the process of heating feed-water with live steam looks like taking money out of one pocket and putting it into another, and it is very far from easy to see how any economy in fuel can result. It is certain, however, that finality has not been reached in the thermo-dynamics of the steam engine; and it was as difficult to dispute the testimony of those who paid for coals and said the live steam heater reduced the consumption, as it was to doubt the accuracy of the view that theoretically no economy was possible. Under the circumstances nothing remained but to put the question to a practical test for ourselves. For some time no opportunity occurred. On Tuesday, however, thanks to the courtesy of Mr. Preston, the Superintendent Engineer of the General Steam Navigation Co., we were enabled to carry out experiments with a heater in a way and with results which we shall now proceed to explain.

The *Oriole* is one of the little fleet of paddle-wheel passenger steamers plying during the summer months between London, Margate, Ramsgate, Deal and Dover. She was built and engined by Messrs. Scott, of Kirkaldy, and is a very fast and beautifully-fitted vessel, commanded by Captain Fishingdon. She is 386 tons register. She is propelled by compound engines, the cylinders lying side by side and inclined at an angle of some 30° with the keel. The cylinders are placed abaft the right-angled crank shaft. The air, feed and bilge pumps are worked by a bell-crank lever from the low-pressure crosshead on the star-board side of the engine-room. On the port side is a double cylinder centrifugal pump for driving water through the surface condenser. The engines indicate about 1,500 h.p. Steam is supplied by three boilers, of the low or Navy type. They are about 9 ft. in diameter and about 13 ft. long. There are in each three plain cylindrical furnaces opening into one combustion chamber, from which extend tubes about 6 ft. long and about 2½ in. in diameter to a smoke-box. There is a single elliptical funnel serving for all three boilers, which stand side by side fore and aft in the ship, forward of the crank shaft. The stokehold extends right across the ship, and is separated from the engine-room by a transverse bulkhead, in which are two doors to port and starboard. There are two firemen on watch, who have to feed nine furnaces; one takes the starboard, the other the port boiler, and they fire the central boiler alternately. Two furnaces are always fired at the same time. The coal used on Tuesday was North-country, of average quality, but with a good deal of small in it and not very clean.

In the aft corner of the stokehold, on the starboard side, stands the heater. It is a plain cylindrical vessel, in which are copper tubes. The feed-water is always passed through this, entering at the bottom and escaping at the top to the boilers. The steam enters at the top through a pipe 1¼ in. in diameter, drawing steam from the midship boiler. The condensed water is led through a small copper pipe into the hot well. The heater occupies a space 6 ft. 10½ in. high by 18 in. by 21 in., and weighs about 21 cwt. By turning a tap on the steam pipe, steam can be admitted to the heater or not at pleasure. There are, of course, by-pass valves, so that if the heater failed the boilers could still be fed in the ordinary way. The safety valves are loaded to 100 lbs.

It was impossible to make any experiments on Tuesday to ascertain the evaporative efficiency of the boilers. The only trials that could be made were, however, of much practical importance. Before the heater was put in the engines were always short of steam. A fan is provided on the crank platform in the engine-room, which delivers air into the stokehold, to work on the assisted draft principle. For some reason, however, not stated, this fan is not used, and it had been found impossible to keep the pressure up to 100 lbs. In some cases, indeed, when the coal ran dirty or small, 85 lbs. could be maintained with difficulty. Since the heater was put in there has been no trouble of this kind. Mr. Harper, the able Chief Engineer, gave us on Tuesday, during a trip from London Bridge to Dover, every facility for carrying out any experiments we pleased. These consisted in working the boilers alternately with and without steam in the heater. Matters were so managed that the firemen did not know whether the heater was in action or not. Indeed, seeing that, as we have said, two men had to manage nine fires, they had, it may be easily understood, no time to think about heaters. Mr. Harper, like many other engineers, holds that it is on the whole more economical to be satisfied with about 22 ins. of vacuum, than to cool his feed-water below 140°, at which temperature it enters the heater. We used a standard mercury thermometer placed in a thin pipe on the top of the heater, just at the point where the feed-water left it. The temperature ranged between 318° and 320°, corresponding to pressures of 88 lbs to 90 lbs.

No experiments were made until after the *Oriole* had left Blackwall, and could steam full speed without much chance of having to slow up or stop. With the steam off the heater and the feed temperature 140°, the pressure was 92 lbs., and the engines made 34 revolutions per minute. The firemen were fresh and certainly did not spare themselves. And here we may say that all four—two being on watch at a time—were considerably above the average both in physique and skill. The pressure, however, did not rise above 92 lbs. and was kept there indeed with some difficulty. At the end of about three-quarters of an hour steam was turned into the heater. The temperature of the feed began to rise, and in about a quarter of an hour attained 320°. The boiler pressure steadily rose to 97 lbs. and remained there. Obviously the work of firing was easier. The men could put down their shovels for a few minutes and the rakes were not in requisition. We prolonged this experiment until there could be no doubt about the facts. The revolutions rose to 35½, an increase of a revolution and a half. We then had steam turned off the heater, with the result that the pressure began to fall, went back to 90 lbs. and was only got to 93 lbs. by vigorous use of firing tools. Once again we had the heater put into use and the pressure was got up for some time to very nearly 100 lbs. and the revolutions rose to 36. Again, later in the day, the heater was thrown out of use, and the prickers were soon at work to push steam. The remainder of the trip was made with the heater in use.

The broad facts which we ascertained were simply that the heater gave a higher boiler pressure by 5 lbs., and raised the revolutions of the engines from 34 per minute to 35½ per minute. As regards economy, we have no data to go on, save that the firemen let the furnaces more alone with the heater than without. It may be taken as certain that an extra revolution and a half was got out of the engines with less coal per hour when the heater was in action than when it was at rest, but how much less we cannot pretend to say.

It remains to be considered how this remarkable result can be reconciled with thermo-dynamic laws. At first sight it appears to be, as we have said, impossible that any result of the kind could be got, or that any economy should result. But we think that an hypothesis may be constructed which will show that there is really nothing at all inconsistent with thermo-dynamic laws about the matter. If we take into account the well-known fact that heating surface is, for some reason not fully understood, more efficient with boiling water than with cold; that all grease is kept out of the boiler, being deposited in the heater, from which it is periodically removed with soda, and that so the surfaces are kept cleaner, we can at once see that a saving of 5% or 6% is not more than is to be expected. Putting the whole matter in another way, it is clear that the efficiency of a boiler working with hot feed will be greater than the efficiency of a boiler working with cold feed.

The Kirkaldy heater is supplied with steam from a boiler working with feed-water at a very high temperature indeed, and the efficiency of each pound of fuel employed to heat that feed will be greater than it would be if the steam were supplied by a boiler working with cold feed. From this point of view it will be seen that a moderate gain is just what may be expected under thermo-dynamic laws. The fact that there is a greater gain than calculation indicates as possible is explained, as we have said, by the more or less uncertainty which exists as to the influence of the density of the water in a boiler on the rate at which it will take up heat. Each unit, again, of heating surface will probably in a given time transmit about the same quantity of heat, whether the water in contact with it is 200° or 350°, or even hotter, because the furnace temperature is always so much in excess of the water temperature that 100° or 150° one way or the other makes little difference; but it is obvious that, if the water be very hot, more steam will be produced in a given time per unit of surface than if it be cold. The result is equivalent to an augmentation of furnace-heating surface, and, as in the case of the *Oriole*, more steam will be made per hour than could be had from the same boilers with cold water. The steam used in heating the feed is used to the best possible advantage, the whole of its contained heat being utilized; whereas if the same steam were passed through the engine, not more than 12% of its heat could be utilized.

Our readers must not run away with the idea that when a live-steam heater is used something is being got for nothing. That is not the case. There must under any circumstances be work done by the fuel in raising the temperature of the feed-water. Can that work be done more economically by using live steam than by pumping lukewarm water into the boilers, and using the live steam in the engine? The reply supplied by practice is that it can, and the theory we have advanced seems to explain why this should be so. It simply means, among other things, that a given weight of steam can be utilized to more advantage in heating feed-water than in turning a crank shaft; and that a given weight of fuel can be used to more advantage in making steam than in heating water.

*From *The Engineer*, (London) July, 3, 1891.

LITERARY.

Part V of *Maxims and Instructions for the Boiler Room* (25c.); by Prof. Hawkins, published by Theo Audel & Co., 90 Liberty St., New York, is received. This part (one of 10) treats largely of the corrosion and incrustation of steam boilers, and the best methods for preventing the losses and dangers arising therefrom. This is certainly a subject of the deepest interest. The number also gives a section of chemical terms and explanations relating to feed waters in which are defined acids, alkalies, oxides, sulphates, etc. We quote from this section: "In view

of the increasing importance laid upon a knowledge of the chemical formation of feed waters, these chapters of chemical terms and analysis of feed waters are given *to indicate the direction in which the advanced engineer must push his enquiries.* There are more millions of treasure to be made by properly 'treating' the waters which enter the steam generators of the world, than can he extracted from its gold mines."—

"Engineers' examinations" and "steam boiler inspections" are also subjects treated in Part V of this admirable publication.—

The Annual Report of the Chief of the U. S. Navy Bureau of Steam Engineering, for 1890 (just issued), shows of the $605,000 appropriated for the fiscal year ending June 30, 1890, the sum of $574,879.89 was expended in connection with Uncle Sam's naval vessels. The report states the work done on the machinery of naval vessels, and specifies their psesent condition, with the work required of each vessel.

Hewlings' Directory of steam specialties and engineering appliances for 1891, price $1, published by A. J. Hewlings, 218 Lake Street, Chicago, comprises complete classified lists and alphabetical index to manufacturers of, and dealers in steam engines, pumps, radiators, valves, grates, lubricators, gauges, condensers, indicators, exhaust heads, heaters, filters and purifiers, belting, and all steam appliances. It is a very useful book of references, although it is not as complete as might have been. In looking over it somewhat hurriedly, we notice that the new Calkins' steam engine indicator is omitted. But whatever its shortcomings Hewlings' Directory should he in every office where business in steam appliances is carried on.

Scribner's Magazine for August is a "Fiction Number," and contains five complete short stories by Thomas Nelson Page, T. R. Sullivan, A. A. Hayes, Annie Eliot, and John J. a'Becket. Four of the stories are illustrated, each by an artist chosen for his skill in delineating the special characters and incidents which are the features of the tale. Albert Lynch, the famous French illustrator, W. L. Metcalf, Charles Broughton, and W. L. Taylor, are the artists whose work adorns these stories, producing a variety and delicacy of illustration seldom seen in a single issue of a magazine. This number also contains a long opening instalment of the new serial, "The Wrecker," by Robert Louis Stevenson and Lloyd Osbourne. The action of the story takes place, for the most part, in San Francisco, and in the South Sea Islands, among which the authors have been cruising for several years The leading character is an American, and the story is one in which scene and action will strongly appeal to American readers. This instalment and each of the following will contain a single full-page illustration by William Hole, who illustrated "The Master of Ballantrae." In addition to the abundant and entertaining fiction, this number contains another article in the Great Street series—"Piccadilly," by Andrew Lang, with many characteristic illustrations by W. Douglas Almond, a very capable English artist. There is also a final article by Professor John H. Wigmore, on "Parliamentary Days in Japan," with a view of the parliament buildings recently burned, and a modern Japanese political caricature. Poems by Archibald Lampman, Mrs. James T. Fields, Louise Chandler Moulton, and Archibald Gordon, with the "Point of View," complete a charming midsummer "Fiction Number."

Map of the United States.

A large, handsome map of the United States, mounted and suitable for office or home use, is issued by the Burlington route. Copies will be mailed to any address on receipt of 12 cents in postage by P. S. Eustis, Gen'l Pass. Agent, C., B. & Q. R. R., Chicago, Ill.

TRADE NEWS.

The following is a list of recent shipments of The Ball Engine Co., Erie, Pa.: Temple Beth El, New York City, two 80 h.p. engines; Johnson Co., Johnstown, Pa., three 150 h.p. engines, and one 300 h. p. cross compound engine; FrishmuthBros. & Co., Philadelphia, Pa., one 25 h. p. engine; Gambrinus Stock Co., Cincinnati, O., one 25 h. p. engine; Bennett, Sloan & Co, New York City. one 25 h. p. engine; Allentown Rapid Transit Co.. Allentown, Pa., two 125 h. p. engines; Lebanon Street Railway Co., Lehanon, Pa., one 50 h.p. tandem compound engine; Edison General Electric Co., New York City, one 80 h.p. engine; E. T. Copeland & Co., New York City, three 80 h.p. engines, and one 25 h.p. engine; Schuylkill Electric Railway Co., Pottsville, Pa., one 125 h. p. engine; Durham Electric Light Co., Durham N. C., one 80 h.p. engine and boiler; Amsterdam & Rockton St. Ry. Co., Amsterdam, N. Y., one 100 h.p. tandem compound engine; Corvallis Electric Railway Co., Corvallis, Wash.. one 150 h p. tandem compound engine; Olean Electric Light Co., Olean, N. Y., one 150 h.p. tandem compound engine; Boston & Great Falls Electric Lt. & Pr. Co., Great Falls, Mont., one 150 h.p. engine; Crook, Horner & Co., Baltimore, Md., one 25 h.p. engine; Northwestern Electrical Supply Co., Tacoma, Wash., one 25 h.p. engine; E. Meyer, New York City, one 80 h.p. engine; Reading & Southwestern St. Ry. Co., Reading, Pa., two 125 h.p. engines; Key West Gas & Electric Light Co., Key West, Fla., one 150 h.p. one 100 h.p. and one 60 h.p. tandem compound engines, two 150 h.p. boilers, one 300 h. p. Wheeler condenser, one 300 h. p. Davidson air and circulating pump, one 300 h.p. Davidson boiler feed pump, one 300 h. p. Korting Injector, etc., Trenton Lamp Co., Trenton, N. J., one 35 h.p. engine.

At a meeting of the stockholders of the National Iron and Brass Works, Dubuque, Ia., held July 15, 1891, it was decided to change the title of the company to "The Smedley Manufacturing Co." by which it will be known in the future. No changes will occur in the management or class of business done. The company will still continue to operate its factory and iron and brass foundries on a larger scale than ever, as additional buildings are being erected, and large additions are being made to the machinery and facilities of the company, so as to more promptly care for its growing business, of which the building of the Smedley steam pumping machinery, and the construction of waterworks plants, or furnishing supplies for same, will continue to form an important part; but they will always endeavor to care for any other demands in foundry, or mechanical wants that their patrons may have. The hand pump and supply department will continue to be a prominent feature in their business. As western agents for the Trahern Pump Company, Columbia Pump Company, and Tennessee wood pumps The Smedley Manufacturing Co. can care for wants in those lines promptly, as well as in engines and boilers, iron pipe and fittings, brass goods, (steam and water,) hose, belting, packing, and lubricating oils.

The Hoppes Manufacturing Co., of Springfield, O., made sales to the following firms during July, through their Minneapolis office (Mr. E. Webster, manager), namely, Berry Bros. (millers), Norwood, Minn.; Everett Aughenbaugh & Co. (millers), Wascca, Minn.; and Ed. Haakenson & Co. (packers), Sioux City, Ia. The Hoppes live steam feed water purifier, and exhaust steam feed water heater give good satisfaction.

CONTRACTS OPEN.

Pumping Engine.—Sealed tenders will be received at the office of the Board of Water Commissioners, Woodstock, Ont., up to and including Saturday, Aug. 15, 1891;

1. For the furnishing and erection of a steam pumping engine of 2,000,000-gall. capacity.
2. The furnishing of pipe and laying of an 18-in. earthenware conduit about 17,000 ft. in length.
3. For furnishing hydrants and valves required in the distribution system.

Specifications and all information pertaining thereto can be obtained from the engineer, W. M. Davis, Woodstock.

The Board reserves the right to reject any or all bids.

All tenders to be addressed to the undersigned.

Geo. C. Eden, Sec'y of Board.

Stand-Pipe.—Sealed proposals will be received by the Trustees of the Illinois Northern Hospital for the Insane, until 12 o'clock, noon, August 4th, 1891, for furnishing the material and erecting of a stand-pipe of 100,000 gals. capacity upon the grounds of the said Asylum, at Elgin, Illinois, according to the plans and specifications on file in the office of the Superintendent.

Each proposal must be signed with the names of the party or parties interested, and must contain a deposit in cash or a certified check for 10 per cent of their bid, which will be returned to the unsuccessful bidders. The successful bidder will be required to furnish an approved bond for the faithful performance of the work.

Proposals will be addressed to the Trustees of the Illinois Northern Hospital and marked "Proposals for Stand-Pipe."

The right is reserved by the Trustees to reject any and all bids. H J. Brooks, M. D., Superintendent. W. S. Gamble, Engineer.

Water-Works.—Sealed proposals will be received by the City Council of the City of Washington, Washington County, Iowa, until 12 o'clock noon of the 17th day of August, 1891, for furnishing material and constructing water-works in said city.

The work to consist of a building, storage reservoir of 30,000 gallons capacity, one standpipe 14x110 feet, one artesian well pump, two duplex pumps, capacity of 600 gallons per minute each; two boilers, 50 horse power each; 380 tons cast-iron pipe, about 10 tons specials, 38 hydrants, 20 gate valves.

Bids will be received for the whole or any particular branch or subdivision of the work and materials at the option of the bidders.

Full drawings may be seen in the office of the City Clerk at Washington, Iowa, or in the office of Geo. W. Wynn, Consulting Engineer, at Cedar Rapids, Iowa.

For copies of specifications and form of proposals address J. J. Kellogg, City Clerk, Washington, Iowa.

The right to reject any or all bids is reserved.

J. G. Hise, Mayor. F. E. Lamphere, W. S. Reister, Frank Stewart, Aaron Hise, W. N. Hood, Water Committee.

Water-Conduit.—Sealed proposals will be received by the City of Savannah, office Water-Works, Savannah, Ga., until eleven (11) o'clock a. m., Aug. 26, 1891, for the construction of a Water Conduit of masonry, on masonry and timber, having an internal diameter of approximately six (6) feet and a length of three thousand (3,000) feet, more or less, all to be in accordance with general specifications on file in the Water Office at Savannah, Ga., or which, with other information, can be obtained from Thos. T. Johnston, Consulting Engineer, at Room 29, No. 171 La Salle St., Chicago, Ill. Proposals must be made in accordance with aforesaid general specifications. Proposals must be accompanied with a cash deposit of two thousand ($2,000) dollars or a certified check for two thousand ($2,000) dollars drawn in favor of the properly authorized agent of the City of Savannah, to be returned or retained in accordance with the general specifications. No proposal will he entertained unless the party furnishing it can offer evidence satisfactory to the Mayor and Board of Aldermen of the City of Savannah of his ability, and that he has the necessary facilities, together with pecuniary resources, to fulfill the conditions of the contract and the specifications, provided such contract should be awarded to him.

The right is reserved to reject any and all proposals not deemed to the best interests of the city.

James Manning, Superintendent.

Stand Pipe.—Sealed proposals will be received by the Trustees of the Illinois Northern Hospital for the Insane, until 12 o'clock, noon, August 4th, 1891, for furnishing the material and erecting of a stand-pipe of 100,000 gals. capacity upon the gronnds of the said asylum, at Elgin, Illinois, according to the plans and specifications on file in the office of the superintendent. Each proposal must be signed with the names of the party or parties interested and must contain a deposit in cash or a certified check for 10 per cent of their bid, which will be returned to the unsuccessful bidders. The successful bidder will be required to furnish an approved bond for the faithful performance of the work. Proposals will be addressed to the Trustees of the Illinois Northern Hospital and marked "Proposal for stand-pipe." The right is reserved by the Trustees to reject any and all bids. H. J. Brooks, Superintendent, W. S. Gamble, Engineer.

Pump.—Bids wanted for one duplex steam pump, 4-inch discharge. Water to be forced up an incline of 1,700 feet—perpendicular 45 feet—total height 100 feet. State number of gallons guaranteed per hour with 20-horse boilers, 50 pounds pressure, also one 20-horse flue boiler without firebox, including smoke-stack, gong, whistle, good size gratebars, boiler not less than 5-16 thickness of steel, also 2,000 feet cast-iron water pipe 4-inch, also 3,000 feet 6-inch cast-iron water pipe, four 6-inch elbows, one 4-inch elbow, elbows to be large in centre, 6-inch pipe to have connections for at least four fire hydrants, also six connections for 4-inch pipe. Separate bids taken. Send bids to Sam Walker, Milledgeville, Ga.

AUGUST 8, 1891. **The American Engineer.** VOL. 22, NO. 6.

THE ALLEGHENY COUNTY LIGHT COMPANY, OF PITTSBURGH, PA.

The history of each single central electric light station is invariably one of constant growth. The case of the Allegheny County Light Company is no exception, and an interior view of their engine-room shows that they have utilized every particle of space at their command.

In the early days of electric lighting such a development was never even considered, and this plant was located in the center of the city of Pittsburgh, so surrounded by business blocks as to prevent increase beyond certain narrow limits. The business of this company has now become so large that they operate two additional central stations in Allegheny.

As is usual with a new industry, little thought was given to conveniences, and the station depends almost wholly on artificial light in the day time. As an indication of the quality of the illumination, we note that the photographic plate (from which the following cut is made) required eight hours' exposure, where an exposure of ten minutes should have been sufficient.

In the foreground, at the left, is shown the first compound engine built by The Westinghouse Machine Company, which is giving as good service as their latest pattern, it is claimed.

At present (but increasing rapidly) the plant in detail consists of the following engines:

Station A.

	H. P.
One 28x48 Corliss, rated at 500 h. p	500
Three 18x16 Westinghouse Standard	750
Three 8½x8 " "	105
Four 14 and 24x14 " Compound	800

Station B.

	H. P.
Three 18 and 30x16 Westinghouse Compound	900
Two 15½x14 " Standard	400
Two 13½x12 " "	300

Station C.

	H. P.
One 14 and 24x14 Westinghouse Compound	200
One 13½x12 " Standard	150

The above makes a total of 20 engines, aggregating 4,105 h. p.

And following is a list of the dynamos:

Station A.

	Lights
Five 3,000 Light Westinghouse Alternating Current	15,000
One 1,800 " " " "	1,800
Three 500 " " Direct "	1,500
Three 300 " " " "	900
Nine 60 " Brush Arc Machine	540

Station B.

	Lights
Three 3,000 Light Westinghouse Alternating Current	9,000
Two 2,500 " " " "	5,000
Five 100 " " Direct "	500
Six 60 " Brush Arc Machine	360

Station C.

	Lights
Six 60 Light Brush Arc Machines	360

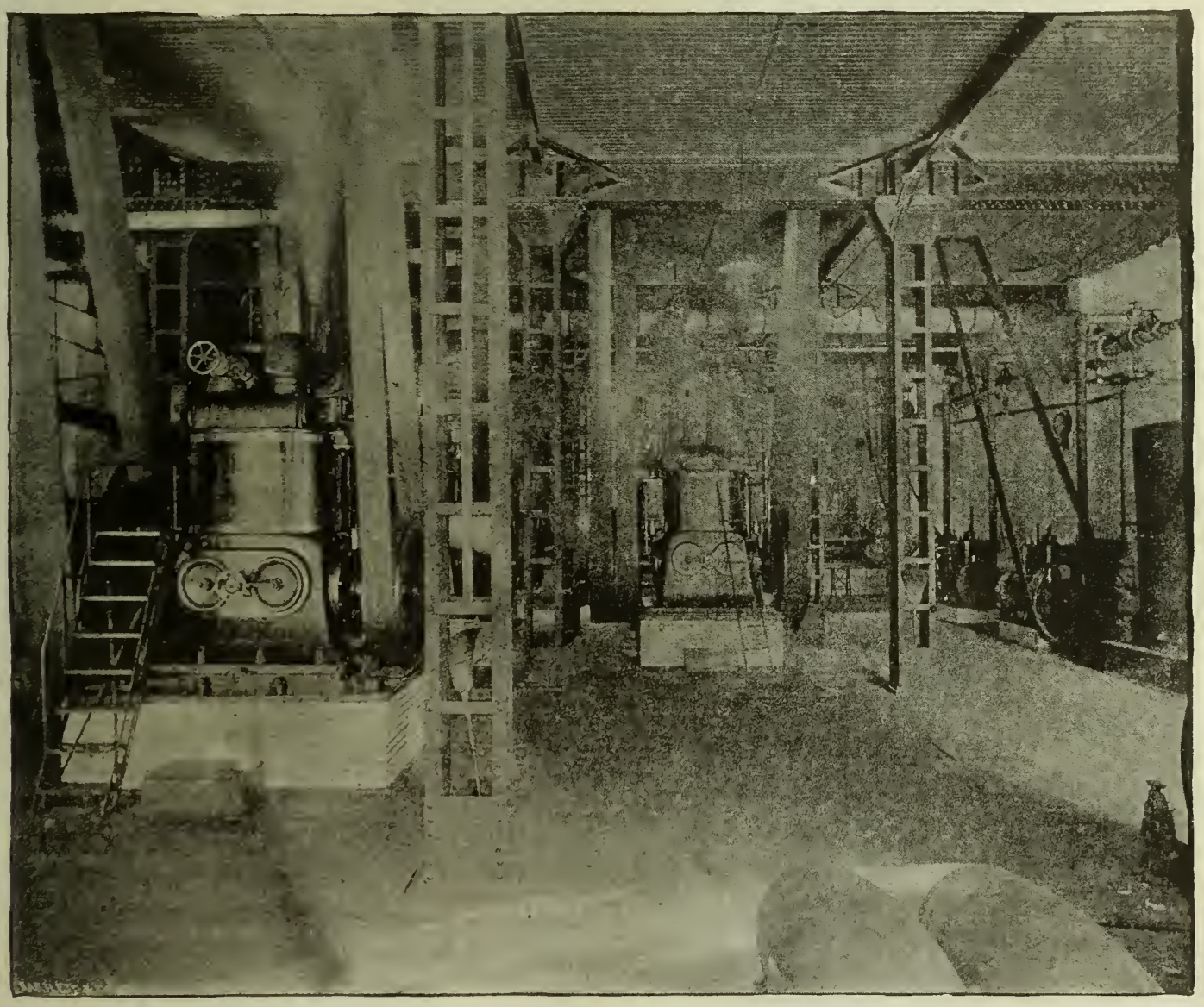
Thus the three stations have a total capacity, in lights, 33,700 incandescent, and 1,260 arc lights.

Corliss engines have been gradually replaced by the Westinghouse high-speed engines, closely grouped on the ground floor and belted direct to the dynamos in the second story. In some cases three dynamos are driven by one engine, while the exciter engines and dynamos have been run over thirteen months without a stop.

There is little to recommend in this arrangement of machinery, except where it is desirable to crowd a large amount of power into a very small space.

In the boiler-room the use of natural gas as fuel has permitted the erection of a second series of boilers over the first, without in the least interfering with its proper working.

In spite of the structural drawbacks of this station, and its division into three parts, the service is said to be excellent. The company will erect a new station in a short time, and concentrate their force under one roof. With the valuable experience which the officers of this company have had since the early days of electric lighting, it seems hardly necessary to say that the proposed new station will be a model of its kind. Like many others, they are bound to profit by former short-sightedness, and provisions for future extensions will no doubt be made in their proposed new and improved central station.



POWER ROOM OF CENTRAL STATION "A" ALLEGHENY COUNTY LIGHT COMPANY, PITTSBURGH, PA.

ECONOMY OF TIE PRESERVING.

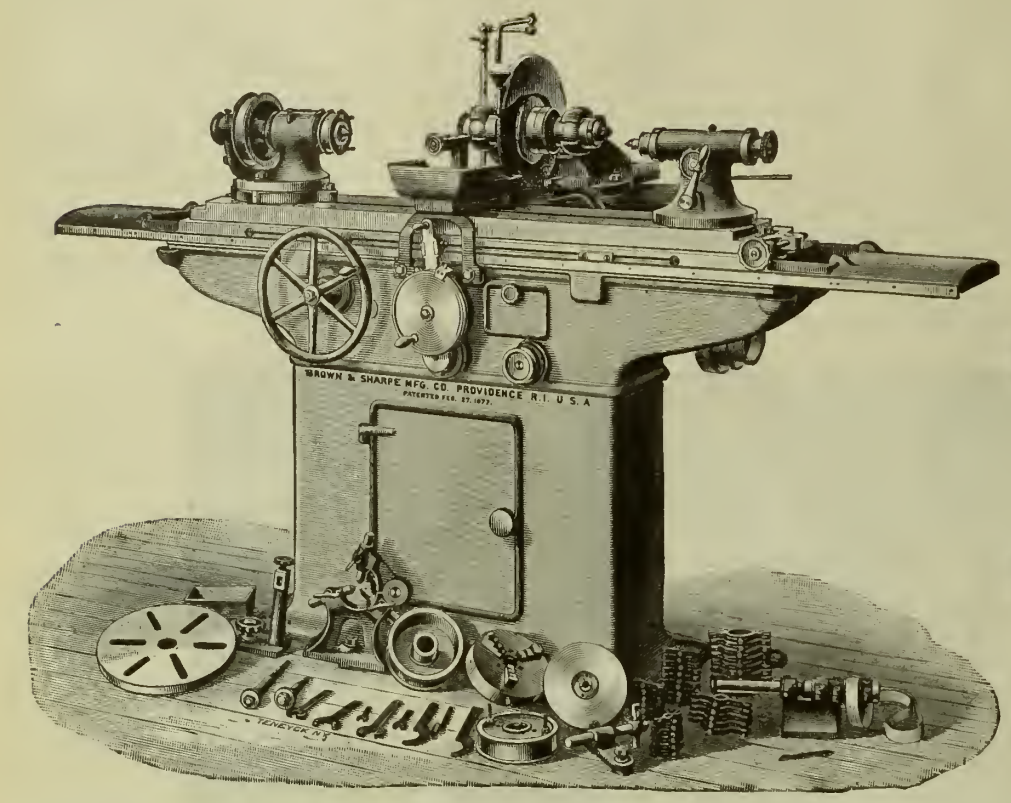
During his recent visits to Europe, Mr. O. Chanute, of Chicago, gathered valuable data concerning the methods and results of preparing wood chemically to resist decay. And he is now confirmed in the opinion that the time is now fully arrived when large economies may be realized by the adoption of those methods on American railroads.

Mr. Chanute proposes to make this a specialty, and is prepared, in connection with the Chicago Tie Preserving Company, to design, erect and operate works for preserving wood. No doubt Mr. Chanute knows whereof he speaks, and he is likely to meet with great success in this undertaking. His plan is understood to be far better than the zinc-tannin process, which has proved to be a great help to preserve railroad ties from decay. And Mr. Chanute is convinced by experience that on many railroads, where white oak is getting scarce, an economy of at least $100 a year per mile of track can be effected by preparing ties of inferior kinds of wood to resist decay by the zinc-tannin process.

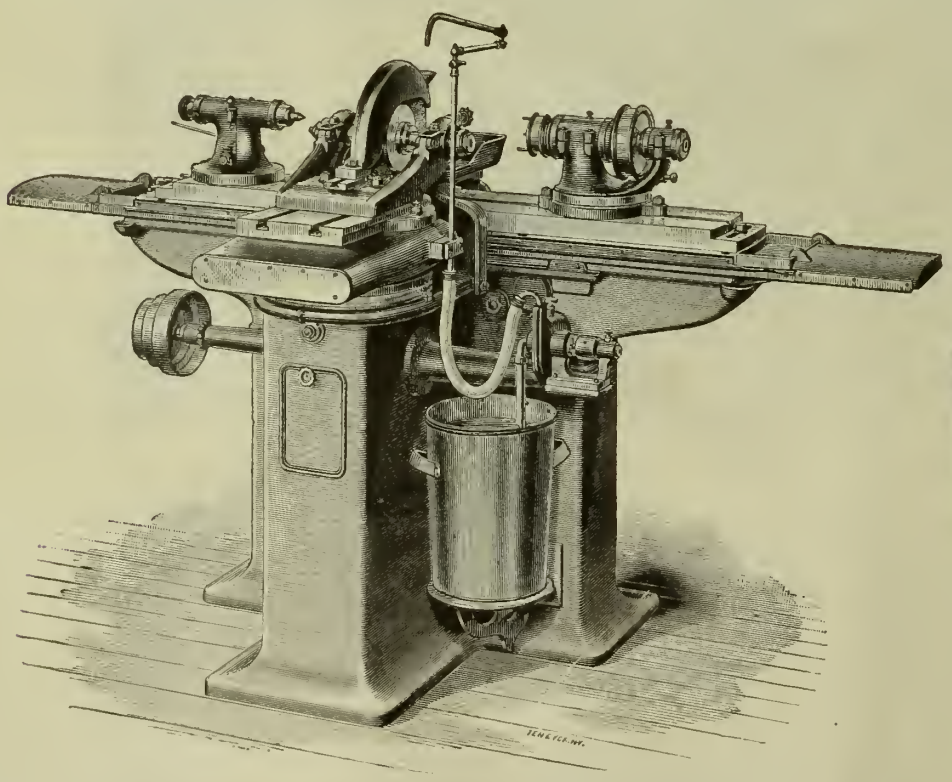
"A Novelty on Wheels" is the caption of an article the Boston *Herald* describing a palace drawing room and sleeping car combined, built by the Harris Palatial Car Co., of Boston. According to the *Herald* it is "a thing of beauty," and such a carriage that Emperor William would like to ride in.

BROWN & SHARPE GRINDING MACHINES.

The accompanying engravings are selected from the new Treatise on the Construction and Use of Universal Plain Grinding Machines just issued by the Brown & Sharpe Mfg. Co., of Providence, R. I. The electro-plates in the first two columns (on this page) are perspective views of their No. 2 Improved Universal Grinding Machine, the lower one showing the rear side. The machine is adapted to resist vibrations within the machine itself, which is an indispensable element for the durability of the machine and for accuracy in the work produced. The base rests upon three feet, and has an internal web bracing. It is fitted as a closet, with shelves on each side of the door. The bed is made in box form, and well braced by cross ribs. From the bottom of the bed there is a descending pipe through which the waste oil can be drawn off. Upon the bed the sliding table moves on one V and one flat way. These bearings are twice as large as in the No. 2 Universal Grinder, and are lubricated by two rolls in each, and the oil is thus equally distributed over the bearings, and the proper position of the sliding table is maintained,—a feature of consequence in accurate grinding.



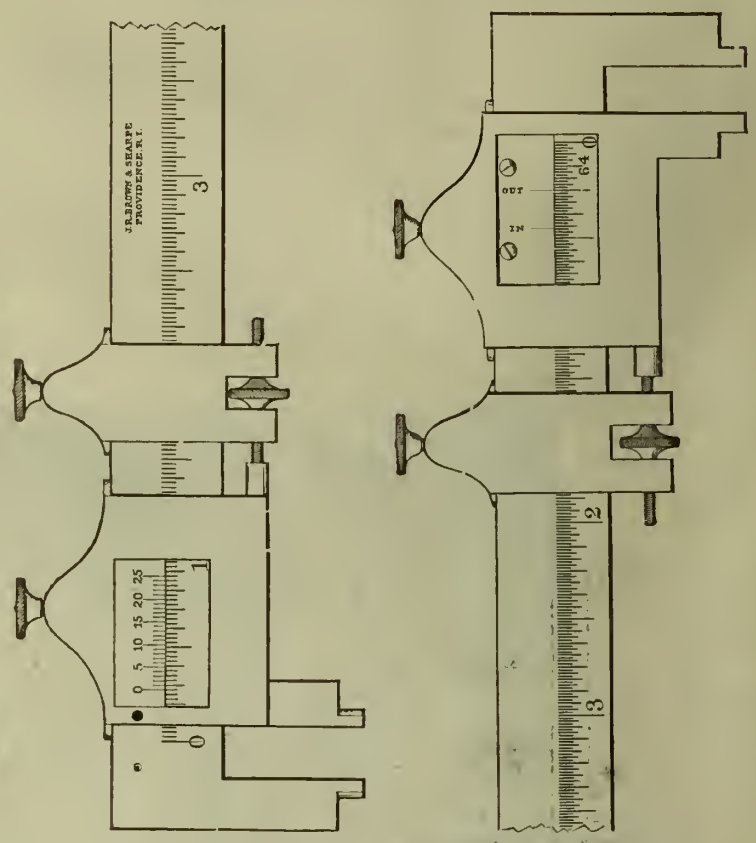
The sliding table is heavier than that of the No. 2 Universal Grinding machine, weighing, with swivel table and head and foot stocks, 225 pounds more than the corresponding parts of that machine. The shallow basins (one at each end of the table), form convenient places for wrenches and other tools in frequent use about the machine. The dust caps beyond the basins protect the slides when the table travels to its extreme movement, and, where accuracy is required, these basins should not be loaded with weights or heavy parts of machines. The caps are curved to prevent weights being placed at the extreme end of the platen.



The Vernier Calipers, back and front views of which are given at top of third column, are extremely convenient for accurate measurements, and may be readily set to any desired distance, the jaws being also adapted for inside as well as outside measuring. They are divided to read to the thousandth part of an inch on one side, and on the other to sixty-fourths, or to one-fiftieth part of a millimeter (1-50 m. m.=.0007874 inch), as may be desired. The Caliper shown in these cuts is made in different lengths, from six to twenty-four inches. They make a smaller size, convenient for the pocket. And directions for setting and reading the Caliper accompany each instrument.

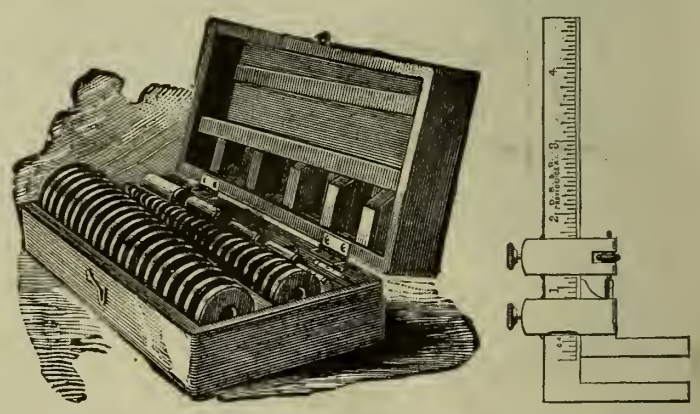
The case cut, below the Calipers, shows how the standard reference disks are kept. These disks are used, generally without handles, for setting calipers, testing measuring tools, and as reference for sizes in shop practice. A complete set (in a box) consists of 45 disks, varying by 16ths of an inch, from ¼ inch to 3 inches diameter, and six handles. With handles they are used in place of standard cylindrical guages, but are not recommended for constant use as substitutes for these.

The Caliper Square, shown in the last cut on this page, is a convenient tool for ordinary use. It is graduated on one side to sixty-fourths, and on the other to hundredths. There are different sizes of these tools, varying from two to nine inches in length, either with or without the adjusting screw.



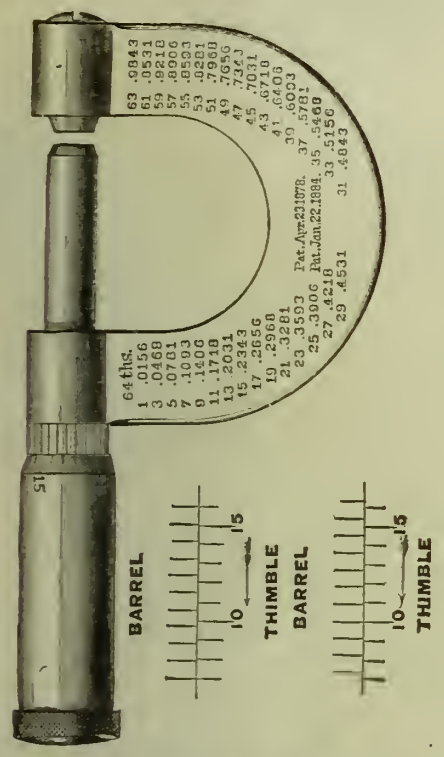
The next cut shows a Micrometer Caliper, shown full size, which is perhaps the most convenient and accurate instrument for small external measurements. They are made in various sizes. The smallest measures up to one-half inch, and the largest all sizes up to two inches. They are graduated to read to thousandths of an inch, but one-half and one-quarter thousandths are readily estimated. Some of the Calipers have verniers by which sizes can be obtained to ten-thousandths. They also graduate some of these instruments to read to hundredths of a millimeter instead of to thousandths of an inch. When they are so graduated the tables of decimal equivalents are omitted.

The gauge screws are encased, and protected from dirt and liability to injury. The parts most subject to wear are hardened, and means of adjustment are provided to compensate for wear of the screw or nut. The decimal equivalents stamped on the frame are very convenient, and render possible the immediate expression of readings in eights, sixteenths, thirty-seconds and sixty-fourths. The chief mechanical principle embodied in the construction is that of a screw free to move in a fixed nut. An opening, to receive the work to be measured, is afforded by the backward movement of the screw, and the size of the opening is indicated by the graduations. The pitch of the screw is forty to the inch. The graduation of the hub, in a line parallel to the axis of the screw, is forty to the inch, and is figured, 0, 1, 2, etc., every fourth division. As the graduation conforms to the pitch of the screw, each division equals the longitudinal distance traversed by the screw in one complete



rotation, and shows that the Caliper has been opened one-fortieth or .025 of an inch. The beveled edge of the thimble is graduated into twenty-five parts, and figured every fifth division, 0, 5, 10, 15, 20. Each division, when passing the line of graduations on the hub, indicates that the screw has made one twenty-fifth of a turn, and the opening of the Caliper increased one twenty-fifth of one-fortieth, or a thousandt of an inch.

In the manufacture of machinery where interchangeability is an essential feature, the gauging system is an important factor in the cost of production. For instance, if it be desired to have a lot of five-eighths inch (=.625) shafts made, all of which should fit the same size bearing, it would be a very expensive process to grind all these shafts exactly to .625 of an inch in diameter, as the care required and the time consumed in guaging and testing them would amount to a large portion of the time of production. But the time required to grind these shafts can be reduced considerably, if the workman is told that he is allowed a variation



of .002 of an inch in the diameter; that is, all shafts which are ground less than .624 and more than .626 of an inch in diameter are rejected. To work conveniently between these limits the workman should be provided with *limit gauges, or snap gauges* as they are commonly called, which are made in various forms.

That shown in cut marked Fig. 33 is a convenient form of gauge, which has two measurements between the jaws at one end of the gauge. The larger size is at *A* and the smaller limit at *B*. The shaft, then, to be accepted, must enter freely at *A*, but not enter at *B*. When these gauges are made of good steel and properly hardened they wear very slowly. When they become worn the jaws can be frequently closed to the proper size again by careful peening. To reduce the wear to a minimum the shaft should be passed through the jaws but once in testing. A convenient way of applying the gauge is shown in Fig. 34. The gauge is held in the right hand while the shaft is passed between the jaws by pressing it with the thumb, then, instead of returning it through the jaws, it is withdrawn endwise.

Fig. 33.

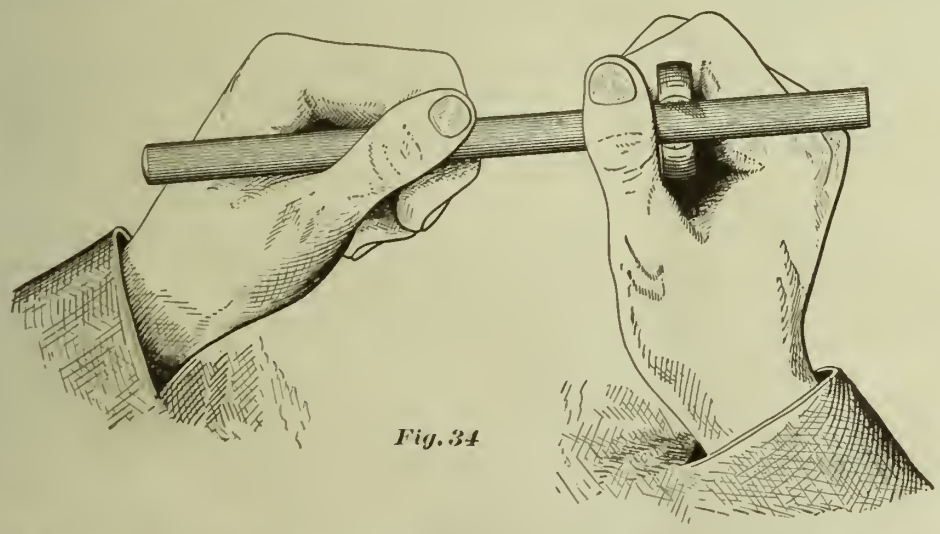


Fig. 34

A "COUNTRY GENTLEMAN" INVENTS A ROTARY EXPANSIVE STEAM ENGINE.

As reported in the *Glasgow Herald*, a really economical rotary engine, combining the advantages of strength, durability, lightness, small bulk, and accurate workmanship, has just been produced by Mr. A. F. G. Brown, of Swindridgemuir, Dalry, Ayrshire. Mr. Brown is not an ordinary mechanic or an engineer by trade, but a country gentleman, having a natural inventive turn of mind, and being impressed by the fact that the designs of Watt and the Earl of Dundonald were frustrated in a great measure by their inability to produce a machine of the above-mentioned qualities, due to the rough tools they had to work with and the then current abhorence against high-pressure steam.

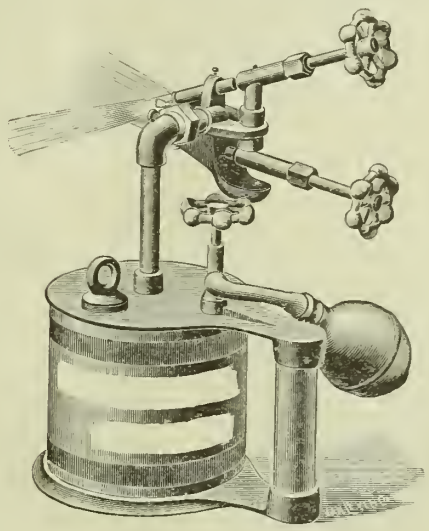
Mr. Brown's engine consists of a cylinder, truly bored and ground to gauge, in which revolves a pistou of peculiar shape, keyed to a central shaft which protrudes through the cylinder cover stuffing-boxes and glands at each end. On one outer end of this shaft is fixed the valve gearing, and on the other an overhanging fly-wheel, which may be coupled direct or through the intervention of belting to any machine which it is desired to drive. The valve gearing consists either of eccentric motion or of three toothed wheels, of which the central one is keyed to the central shaft, and it drives the two outside wheels, which are fixed to rotating valves placed respectively between the boiler steam pipe inlet, and oscillating doors. These doors form when closed, part of the inner circumferential surface of the cylinder. The two outside wheels may be so adjusted with respect to the central one that the steam can be cut off at any desired part of the piston's revolution, or they may be connected to a governor, so as to cause a constant speed to be maintained under widely different loads and steam pressures. The steam inlet doors to the cylinder always bear steam-tight against the revolving piston, and are automatically opened by the pressure of steam acting behind them whenever the piston comes to the point where admission of steam should take place. They are also automatically closed during the time that exhaust takes place by the piston. It will thus be seen that there are very few working parts, and that those which exist are of such a nature as not likely to get out of order, or to become leaky owing to the clever device of spring-adjusted fitting strips proportioned to the pressure and space through which the moving parts have to work. The cylinder receives steam twice during each revolution of the piston, and the higher the piston speed the greater is the economy, as proved by a set of brake horse-power and indicator diagram trials. The size of the cylinder employed in this instance was 10½ in. diameter by 8⅝ in. long, with a piston occupying half the volume of the cylinder. The engine gave by indicator cards 29 indicated horse-power and a mean of 20.78 brake horse-power throughout five hours' run at 574.5 revolutions per minute, with an initial steam pressure in the cylinder of 80 lbs. per square inch. The economy of steam is greater than any recorded results of any other rotary steam engine, and quite equal to the best performances of William's famous engines of the simple, single-cylinder, non-condensing type, for the gross weight of feed-water used per indicated horse-power-hour was only 27.2 lbs. This consumption would have been still less had it not been for the type of boiler used, the right-angle bends in the steam pipes, and the neglect to have these pipes properly lagged and the cylinder jacketed; for, 30 per cent of the weight of steam used passed into the cylinder as water held in suspension and from initial condensation.

THE ENGINEER'S TORCH.

The accompanying electrotype (in this column) represents what was originally known as the Electrician's Torch, and afterwards it was called the "Helper" Soldering Torch. From this time forth it may well be known as The Engineer's Torch.

It burns gasoline, and is a most useful device. Many of them have been sold; but yet there is much ground unoccupied; and as the article becomes more known the demand for it will increase.

It is the most complete contrivance in the market for the use of electricians or linemen, and for wiring. It is safe, durable, easily repaired, has a reversible burner that can be used in any position, will not blow out in a gale of wind. It can be used as a blow-pipe torch, or a tantail heater, and can be instantly changed from an intense heat to a feeble flame, or the reverse.



A brother engineer, who was a delegate to the Supreme Council, at Syracuse, has presented his commission on the sale of these gasoline torches to Bro. Harry Hohn. The torch is well worth its price, and a most useful article for every mechanic and engineer to have.

For further information communicate with H. Hohn, care of F. R. Moore, 727 Filbert street, Philadelphia, Pa.

PRICES OF COAL STATIONARY.

The condition of the coal market was thoroughly discussed by the agents of interior and Western anthracite coal markets, at their monthly meeting in New York, July 29, and the conclusion was unanimously reached that the condition did not warrant any advance in prices. Just as unanimously was it decided that no reduction in prices was warranted. The agents then adjourned until Aug. 27.

The same afternoon the Eastern agents held a meeting in the office of the Pennsylvania Coal Company with the same result as that reached by their Western friends.

CHEAP ALUMINIUM.

The Cowles Electric Smelting and Aluminum Co., Lockport, N. Y., have dropped the price of their best aluminium to 50 cents per pound in ton lots. Now is the time to put the wonders that cheap aluminium would accomplish to the test. 50 cents a pound makes aluminium about as cheap as copper, taking capabilities of the two metals into consideration.

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CONTENTS OF THIS NUMBER.

PAST, PRESENT AND FUTURE OF THE A. O. OF S. E.

The institution of the A. O. of S. E. was a child of necessity at the time of organizing, so it grew. It grew because it had a mission to fill, it grew because there was work for it to do, and it has become a social revolution, a social progression that has continued from its infancy down to the present time. In its infancy it was an experiment, now it is a success, then it was a few men located in New York and Brooklyn, now a vast army of five thousand strong is ranked beneath the banner of the A. O. of S. E., then it was crude in its inception and laws, now it stands in the front ranks of mechanical organizations—and then, some of us who watch the progress of the order in our own jurisdiction can hardly get the full comprehension of its conditions, certainly not so well as looking at it from one side of the broad continent to the other.

The brothers in New Hampshire have common ties with those in California—they are tied together by the bonds of fraternity. A member of New York may find himself in California, many miles away, and he may be there without a dollar or a friend, but all he has to do is to make known the fact that he is a member of the A. O. S. E., and he will obtain relief—he will discover that his brother engineers will respond to that sentiment we call fraternity, and he will find that sentiment something more than an empty name to him.

Now, brothers, the success of this organization in the past has been the result of individual effort and individual work, and the success of this organization from this time forth will be, *must be* the result of the same individual work, and that is the work of the men in the ranks. You may put the very best men you have in offices, but if they have not the support, and have not the encouragement of the members, that is, if the members themselves will not come to the councils and help to do the work, their efforts will be in vain; but "put your shoulder to the wheel," and give your time and talents, and you will not only benefit those with whom you are surrounded, but will in turn be benefited yourself; and when, in 1893, we all go to Chicago, we can say we have every competent engineer in America marching under our banner.

HARRY M. CALLISON.

Syracuse, N. Y., Aug. 1, 1891.

MR. EDITOR:—During my comparatively brief acquaintance with the A. O. of S. E., as a body, and the members thereof, with whom it has been my privilege to have met, various thoughts have come into mind which I should like to express in your columns, as the time seems peculiarly appropriate for such. I may trespass on your good nature as to space; but having the good of the order at heart, I do so with little apology.

The order was started on the broad ground "that every member must stand on his own resources; that the order as a body would not in any way meddle between a brother member and his employer; that the order should take no part in strikes, and that each member's ability would seek and find appropriate scope and reward." The foundation was solid, and strong enough to hold up the superstructure. The principles appealed to the manhood and ideas of fairness of fair-minded and reasonable men, of which it was desired the Order should be composed. In short, the A. O. of S. E. was founded "for the education mentally and morally of engineers; to place them in their proper light before the community as men of integrity and capable of trust: and that the throbbing engines that turn the wheels of commerce, be tended intelligently and with care, instead of becoming weapons of death and destruction." The aim was, first to make every engineer aspire to a higher plane of usefulness in his position as employee, and to teach him by associations of a right kind, that "there is something in being a man." I am reminded at this point of the poet Burns' lines:

What tho' on homely fare we dine,
Wear hodden grey, and a' that;
Gie fools their silks, and knaves their wine,
A man's a man for a' that.

For a' that, and a' that,
Their tinsel show and a' that;
The honest man, tho' e'er sae poor,
Is King o' men for a' that.

The above lines express, better than my feeble pen, the dignity of honest manhood, and are appropriate to this train of thought. The Order has now passed the period of experiment, so to speak, as is evidenced by its rapid growth, and it is a source of much joy, I am sure, to all in sympathy with the Order, to see four or five thousand intelligent men bound together by ties of common brotherhood and desire for the elevation of brother men and consequently "self."

The Order is "a fact." It is well officered in all its branches and on the onward march. There may be, and probably are, some councils that are lagging behind for some cause or other; but these cannot hold back the Order in general, founded as it is, on such principles as are engraved on its escutcheon. The cry is "Forward and Upward," and may the cry never cease until every engineer is what the name implies.

In all bodies of men banded together in some common cause, there are usually found some who aspire to lead. If the men are of the right stuff, their aspirations are generally fulfilled; but some have the aspiration without the ability sufficient to lead. Such men usually create trouble, which is annoying and hurtful in their community, frequently leading to a split and subsequent disbandment. If they can't lead, they are determined no other shall. I am glad to say I have not yet heard of any such in the A. O. of S. E.; and if there be any of that kind, they should be instantly dropped. "A bad egg frequently spoils a good pudding." I will quote Burns again as exemplifying such men, and then leave them to the tender care of their confreres of nobler nature:

O' wad some power the giftie gie us,
To see oursel's as others see 'us!
It wad frae many a blunder free us,
And foolish notion:
What airs in dress and gait wad lea'e us,
And ev'n devotion.

If the rank and file of the Order could have but seen the delegates to the Supreme Council meeting in Syracuse, N. Y., last month, and taken note of the deportment and intelligence of its Supreme officers, it would have caused the flush of pride to rush to the brow of each and every one, for even in bodies where more wealth is displayed, and where intelligence is presumably present, a better front was never presented than that at Syracuse by members of the A. O. of S. E. Vices of every nature were conspicuous by their absence, and it was clearly seen that a man may wear overalls and be smirched with grease, and yet be "a man for a' that." I call attention to this fact for the purpose of acquainting the members that the Supreme officers are all right, so that they may look nearer home for opportunities to better the Order. Let the standard be such in the membership that outsiders will esteem it a privilege to be identified with the Order; for human nature, the world over, is ever striving for the unattainable. At present, to use a figure of speech, "the ship of the Order is sailing on a smooth sea, with sufficient wind in the sails to drive it ahead; but not so fast that it cannot turn quick enough to avoid the breakers. So long as its timbers are sound, it will keep afloat, and be a thing of beauty and a joy forever."

Members of the Order everywhere have certainly cause for congratulation. And now, what of the future? Shall the good work go on with unabated vigor, and with a firmer resolve to put the Order on a stronger footing and a higher plane? But why should I ask? Me thinks I hear four or five thousand throats shout "Yes, and Why Not?" Aye, I know that will be the cry, and I echo "Amen" to the sentiment.

There are two years of hard work ahead, for the next convention of the Supreme Council will be in Chicago in 1893; and then the calcium light of criticism, keen and sharp, will be turned on you. There is nothing that we naturally shrink from so much as criticism, but you give publicity to your presence and intentions, and cannot avoid the tongue of public opinion. Members cannot say that they were not warned. Forewarned is forearmed, and if weak points are found in your armour, you must feel the sharp thrust of the critic. If there are those among you that have better facilities for study and advancement than less fortunate brothers, use your talents for the benefit of others, for it is the main law of mankind, that you do to others as you would have others do unto you. Members wiser than others, can never rise above their Order by withholding this knowledge so long as they stay in the Order, for all bear the same badge—"A. O. of S. E." Would you rise and be wise, brother? Then lift the stone to which you are chained by solemn pledges, and raise it with you, for only thus can you lay claim to the badge of the Order. Let love and sympathy, (to use Brother Jacks' expression) pervade the whole Order, and—

Then let us pray that come it may,
As come it will for a' that;
That sense and worth o'er a' the earth,
May bear the gree and a' that.

For a' that, and a' that,
It's coming yet for a' that,
That man tae man, the world o'er
Shall brothers be for a' that.

You see I have taken another quotation from the immortal "Robbie;" but doubtless many of my readers have come to appreciate his writings as I have. Such sentiments as he expressed cannot fail to leave their imprint on the hearts of men. I will

conclude this article, Mr. Editor and members, by this remark, that when our earthly course is run, may our brothers who are left behind, be able to say in all sincerity and truth, "He was a loyal friend and brother," and what better encomium can we ask for than that?

"Brotherhood and Friendship" are sacred words, and should never be spoken lightly.

Thanking you for your courtesy in according this article space, I remain, Mr. Editor,

"THE DOCTOR."

ELECTRICITY.

VIII.—PLATE GLASS ELECTRIC MACHINES.

Before the steam boiler had been developed into a popular electric machine, the most artistic way of generating electricity was by means of a plate glass machine, and also a cylinder machine. The plate glass instrument superseded the cylinder. And although the steam boiler, as an electric machine, eclipsed it for a while, the plate glass machine is a standard electric apparatus to-day.

In the last chapter it was mentioned that electricity could be produced in many times greater volume by steam than by the plate glass machine. A modern machine of this kind is shown in the accompanying cut, Fig. 8. And one can be constructed now-a-days to produce as much electricity as may be required, that is for the purposes to which those machines are adapted.

A plate glass machine may be made in various ways. Here is one way: Take a round plate of moderately thick glass, and have its edges carefully smoothed. Drill a hole for the axle, through its center. The axle is made of brass, with flanges close to each side of the glass plate, so as to hold it firmly. A part of the winch should be made of glass, because brass is a conductor, and would carry off the electricity. Two rubbers are employed, which are made double, so as to grip the plate, and thus cause friction on the two sides of the glass.

When this kind of plate glass machine was in vogue, quadrants of silk were affixed to the rubber to ensure the conveyance of the electricity to the conductor. A flap of silk was used for the same purpose in the old cylinder machine. And the silk was more effective, in each case, when covered with varnish. The main disadvantage of this machine was the difficulty of insulating the rubber so as to draw negative electricity from it. The conductor was made in various forms, but it was a great mistake to collect the electricity from one side of the plate, as some did. The better plan was to provide a fork for the conductor, to collect from both sides.

Ebonite or vulcanite was sometimes used, instead of glass, for the circular plate. A plate of ebonite, or vulcanite, is not so liable to break as a glass one, and damp will not condense on it so rapidly. For an ebonite plate, hareskin is one of the best materials to use as a conductor. But glass machines, however, have always been mostly used. And the larger the plate, the greater is the amount of electricity obtained. A glass plate from seven to ten feet in diameter would develop enough electricity to "knock a man down."

The machines have been useful for medical and experimental purposes, and they have been the nursing mothers of electrical science.

The accompanying illustration (Fig. 8) shows a modern plate glass machine, such as are for sale by the McIntosh Battery and Optical Co., 141 Wabash avenue, Chicago. This machine has two circular glass plates, the one behind being the largest, as shown by the dark edge in the electroplate. And this larger, or back plate does not revolve at all. To its back are attached two sets of paper and tin-foil inductors, connected with which are two wire brushes. The smaller plate, the one in front, revolves as the handle, shown to the right of the cut, is turned. To the front of this (front) revolving plate are attached a number of metal carriers (six are shown, like periods, in the cut) with raised centers, which are brought into contact with the wire brushes, or in very close proximity to them, as the plate revolves, and thereby the electric charge is generated; and this is rapidly increased by induction.

The metal carriers may be readily discerned, they look like six knobs, on the front glass. Also the teeth, or wire brushes, at the ends of the rods (except one rod end). There are two other brushes shown, the handles of which are attached to the rim of the stationary glass plate, while the brushes rub against the knobs, just as the wire teeth touch them, when the smaller or front glass revolves, which it does when the handle is turned, the wheel at the handles being connected with the axle of the plate by rubber cords as shown in the cut.

It will be noticed that two jars stand in front of the machine, and into these (the construction of which will be explained further on) the electricity is conducted—the positive to one, and the negative to the other. Opposite parts of the plates and opposite inductors and carriers become oppositely electrified, condensation takes place in the jars, and sparks pass between the sliding electrodes, which may be increased to seven inches or more in length.

The sliding electrodes may be readily discerned. From the tops of the jars extend rods with knobs at their top ends; other rods pass through these knobs horizontally, which have handles at the outer ends. These are the sliding electrodes. An electrode is the end of an electric conductor, as mentioned before, or we may say it is the point at which electricity is turned out of its ordinary conductor, or discharged.

The electrodes in these machines slide through the knobs on the top ends of the jar rods. They can be pushed until their knobs touch. Or they can be separated at will, by means of their handles. As shown in the cut, the knobs of the electrodes are apart, and the zig-zag line shown between them is the spark of the electric discharge.

As soon as the handle of the machine is turned, electricity is generated at once, and the electric

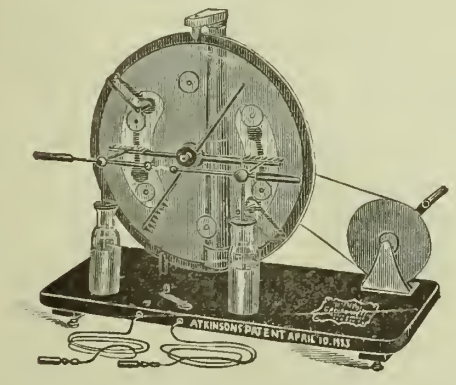

FIG. 8.

charge constantly sustained by the friction of the carriers and brushes; hence the machine remains in practical working order under the most unfavorable atmospheric conditions.

Although this machine is most useful for experiments and amusement, it is said to be in great demand; and it has "staying" qualities inasmuch as it has been discovered that static or frictional electricity is an important factor in medical treatment, and produces certain effects which cannot be obtained from current electricity.

Philip Atkinson, Ph. D., made some patented improvements in this machine, specially adapting it for medical purposes, the most important being the switch (shown between the jars) and its connections with the outer castings of the jars, so as to control the induced current between them. And as this current flows at the same instant with the discharge between the sliding electrodes connected with the inner coatings, it is only necessary to separate them to obtain the interrupted induced current similar to the Faradic.

In connection with the switch are seen cable cords and electrodes, which may be held by insulating handles and applied to any part of the body. Opening the switch changes the current to the cords and electrodes, and on separating the sliding electrodes the Faradic effect is at once produced, which may be varied from the slightest tremor to the most violent muscular twitchings. A separation of one-sixteenth of an inch produces a mild, pleasant sensation; one-eighth to one-fourth of an inch becomes painful, while a separation of one-half to three-fourths of an inch can hardly be borne by the strongest nerves.

One of the delegates to the Supreme Council, at Syracuse, procured shocks from one of these machines, and he expressed surprise at their irregularity, as he expressed it. We have given the above details to enable one to know (if he watches how much the operator move the switch) what to expect.

When the switch is closed and the sliding electrodes drawn out beyond sparking distance, a person seated on an insulated platform and connected by cable-cord with the ball surmounting the jar farthest from the driving wheel will receive a condensed charge of positive electricity, or of negative if connected with the jar nearest the driving wheel. When the charge has been sustained as long as desired, it may be drawn off by a sponge, roller, or point electrode connected with the other jar.

The current flowing from the point is known as the "electric wind," and it produces a cooling, soothing sensation.

The heaviest clothing offers comparatively small resistance to static electricity, so that the removal of clothing is seldom necessary in medical practice; but its passage through clothing or the air always produces a spark, and a sensation more or less painful, as it strikes with accumulated force. A succession of sparks concentrated on one spot produces irritation and reddening of the surface.

An engineer may make a plate-glass machine, without the device covered by the Atkinson patent, for experiment or amusement, at small cost.

The display at night from this machine here illustrated is very impressive; brushes and pencils of light stream and flash from every part, the space between the plates is filled with sparkling scintillations, sparks dart between the exectrodes like miniature chain lightning, while at every flash the rapidly moving disks on the revolving plate stand out as perfect in form as if motionless; thus proving that the spark is instantaneous, and the seeming time occupied in its passage an optical illusion. Moving the electrodes close together, the spark becomes apparently continuous, affording sufficient light to read fine print at a short distance. Here, then, we have practically the electric light with a static dynamo-machine and regulator. By using the Geissler tubes, giving the green, pink and violet colored lights, the effect is very beautiful, and can be varied, using either the direct or induced interrupted current.

IX—THE LEYDEN JAR.

After electrical experimenters had become able to produce electricity, at will, and in considerable quantity, the desire arose for a scheme to "store" it. A sharp-witted electrician argued that, inasmuch as water was a conductor of electricity, the electric force could be stored in a bottleful of water. And to put his idea to a test, he filled a bottle with water, corked it, and passed a wire through the cork, so as to conduct the electricity into the water in the bottle. He set his electrical machine in motion, and fastened the end of his wire thereto, where he left it until he guessed the bottle was full of electricity. Then, to prevent the stored electricity from getting out, there and then, he proceeded to take the wire off, when, surely enough he discovered that he had put in a pretty strong "store," for he received such a violent shock, as he took hold of the conducting wire, that he was subsequently confined to his bed for some time; and he declared that he would never try that experiment any more.

The very element of danger which thus appeared to be connected therewith, induced others to try it. Various improvements were made, by one and another, until the Leyden jar (so-called from Leyden, where the first experiment was made) was successfully constructed.

These Leyden jars may be purchased, all ready for use. And an engineer can easily arrange his steam generator so that it will produce electricity, if he has attentively read our VIIth article, and thereby charge a Leyden jar.

If a man wants to make his own electric storage jar he can make one out of a candy bottle, or some wide-mouthed glass jar, if he will give it a coating of tin-foil inside and out, to within about two and one-half inches from the top. Then get a cover of baked mahogany to fit its opening, or else a bung of some dry material. Through this put a piece of brass wire, with a ball on its top end. A chain should be fastened to the bottom end of the wire such as will reach to the bottom of the jar.

If electricity is generated by a plate glass machine, the jar may be connected with the conductor from which to receive the electricity, just as those jars shown in Fig. 8 are connected to their conductors. But if electricity is generated by steam from the boiler, a conductor (say of copper wire) must be provided.

And in whatever manner the electricity is generated, if a Leyden jar, prepared as directed above, be held with its knob close to the conductor sparks will pass into the jar until it is filled, which will take but a short time. After it has as much electricity as it is capable of holding, it will take no more. If it is then let down, the electricity will not escape from it until it is "discharged." If a piece of wire, say six inches long, be bent into a curve, and one end of it touch the outside of the jar while the other end touches the knob at the top of the wire that stands out through the cover of the jar, there will be a brilliant spark and a loud crack, the result of the jar having been discharged.

In case a wide-mouthed bottle cannot be obtained conveniently, there is a way to make a Leyden jar with a small-mouthed vessel. The wide mouth is wanted in order to put the tin foil inside. With the narrow mouth paste may be used instead of tin foil. The paste should be thick, as it is put into the bottle, and the bottle turned about so as to wet the interior. And if a number of brass or iron filings be now put in the bottle, they will adhere to the sides and form a conducting coating. Tin foil should be outside the bottle, whether the inside have tin foil or filings. Either plan will "store" a charge of electricity.

With filings inside, the discharge will produce a considerable shock; but, instead of discharging all at once (as when prepared with tin foil inside as well as out), there will be a series of two or three shocks, the first strong, the next weaker, and the third very feeble generally. This is because the filings are not in absolute contact.

It is not necessary to connect the outside tin foil with the knob by means of a wire; one hand on the outside coating of the bottle, and the other on the knob, or a wire held in the hand and brought near the knob will have the same result. And a number of persons may join hands, and form a circle, the free hand at one end touching the tin foil on the bottle, and the unoccupied hand at the other end of the chain of hands approaching the knob, either directly or with a piece of wire, and they will all feel the shock as if it was but one person.

The Leyden jar exemplifies the law of induction in electrical science. In the jars shown in Fig. 8 the height of the tin-foil, inside and out, is plainly indicated. The electricity is distributed over these metallic coatings, the interior being positively charged, and this acts on the outside coating by induction, producing negative electricity. The glass jar is a di-electric, that is it separates the positive electricity from the negative, and is the means whereby induction takes place. The electric discharge takes place when means are provided for the positive and negative electricities to get together, and the spark and shock are the result of such re-union.

A battery of Leyden jars may be formed by placing a number of them so that the knob of one jar is connected with the outside of the next, and the knob of that one with the outside of its next neighbor, until all the jars are thus connected. These jars should be placed on glass or some other insulating material, and then, if the knob of the first jar is connected to the conductor from the electric machine, and the outside metal coating of the last jar connected with the ground, the whole row of jars will be charged, the first jar will have the strongest charge, while the last will have the weaker, the charges of the intermediate jars gradually decreasing. The difference between each, however, will be but very slight. This style is called "charging by cascade." Now, if the jars so charged are placed close together (still on an insulating material) so that their outsides may be in contact, and their knobs connected together by wire, a comparatively powerful shock may be obtained.

Indian summer weather was the order of the day in Chicago last week. As we go to press, with this issue, it is as hot as August weather ought to be. Altogether Chicago weather will suit the A. O. S. E.

ELECTRIFIED WATER.

One of our friends from the Union Stock Yards, Chicago, startled us with a question, which it is much easier to ask than to answer, Monday afternoon. He had just read our article on "Electricity in Steam Boilers," published last Saturday, and he thought perhaps we might be able to tell him how it comes about that water in a well becomes electrified.

It appears that the president of said stock yards (John B. Sherman) vacates his mind of the cares of business by visiting Eureka Springs, Arkansas, now and then. And Mr. Sherman astonished some of the engineers, at the Union Stock Yards, recently by telling them that he had seen steam charged with electricity somewhere on the way to Arkansas. Said engineers did not doubt Mr. Sherman's word, but quietly thought he may have been imposed upon. Our article last week, however, opened their eyes to the fact that steam may actually be charged with a large volume of electricity. Thereby their minds were open, for a few days, to believe almost anything. And the Monday afternoon visitor called our attention to a descriptive article in the *Inter Ocean* concerning a well on the Ozark mountains, Missouri, which is said to give forth magnetized water. The author of the article seems to consider magnetism and electricity as the same thing. He may readily be excused for doing so, for the most learned electricians almost do likewise now-a-days.

The writer of the article says he put his hand in the steam issuing from a pump cylinder, said steam being generated from water out of the "magnetic" well, and "instantly" the ends of his fingers "became illuminated."

If nothing more had been stated, we would have concluded that the electricity was generated in some such manner as was explained in our article. But as the water in the well seems to be "magnetized," the electricity may be in the water as it comes from the bowels of the earth.

Extracts from the descriptive article referred to, including a "pedigree" of the magnetic well, may be interesting, and also give our readers a chance to answer the question which staggered us, namely how water becomes electrified in the earth.

The article referred to was written at the Gasconade hotel, Lebanon, Mo., July 26, and the writer says:

"Some years since the citizens of Lebanon had occasion to sink a well for the purpose of obtaining a water supply for town purposes. A hole was bored to the depth of 1,000 feet, water being obtained in great abundance. The well was piped and nothing more was thought of the matter until some time later it was necessary to remove the piping. In order to disconnect it a monkey wrench was applied, when it was noticed that the tool adhered to the pipe. There could be only one cause, and that was that the pipe was magnetized and that it must have become so from having been in the water for quite a length of time. One development followed another until the people of the town were awakened to the fact that they had a magnetic well of more than usual strength, and as a chemical analysis showed the water had the solids and was of a medicinal character capable of effecting cures of many different ailments, the citizens attempted to develop the well and to bring its waters into the use for which nature evidently intended them. Little was done, however, lack of capital being the impediment in reaching even an ordinary degree of success.

"The analysis which was made by a government chemist made a very valuable showing, and in the meantime persons afflicted with various disorders began drinking the water, when the curative effect was perceptibly noted. These facts being brought to the notice of several gentlemen of the city of St. Louis, a careful investigation was made, first to demonstrate the quality of the water in such authentic manner as to leave not a particle of doubt as to their health-giving merits. This was accomplished in a most satisfactory manner. So much so that they decided to open the well to the world. With this end in view the land on which the well was sunk was purchased by a syndicate, a company was organized, and the work of improvement and development began. From that time things began to hum, and to-day the waters of Lebanon have achieved an enviable reputation. As I had been writing letters on the subject of mineral water, especially of that found in the Ozark Mountains, I stopped off here to-day to investigate for myself, having heard of the place all along the line.

"Lebanon is located in the Ozark mountain range, and is a station on the Frisco Road, 180 miles west of St. Louis, the town being the county seat of Laclede county. The water, of course, is the main attraction of the town, and, as may well be imagined, it is putting on airs because of the notoriety given it. The altitude is 1,280 feet. The first improvement to be made was to adopt the most serviceable method of pumping and storing the water. To this end a stand-pipe holding 100,000 gallons was erected. Then improved pumping machinery was purchased and set in motion, all of which, together with buildings and mains that have been built form one of the best water-works systems of the modern day. The next point calling for attention, and which would be a prominent factor in making the place a health and pleasure resort, was the erection of a first-class hotel, to be maintained on such a scale as to attract desirable patronage from St. Louis and other points. This, too, has been done, the Gasconade, the hotel from which I write, being in every feature a most substantial hostelry, such as very few resorts can boast of.

"The entire house including elegant bath-rooms, is supplied with hot and cold water from the magnetic well. The sanitary arrangement has been well taken care of. A pretty lawn in which a fountain plays fronts the hotel. * * * There was put in an electric light plant which now illuminates the entire town and the hotel and grounds of the Gasconade. Another step to be taken was to connect the depot and the now popular hotel by an electric railway, and to-day you alight from the luxurious train of the Frisco, step into an electric motor car and in a few moments you have covered the mile stretch and are registering at the cosy office in the Gasconade, the motor leaving you at the lawn.

"As I have said, there can be no doubt as to the character of the water. Its being charged with electricity was demonstrated to me in a startling manner. After dark I went into the pump house. The lights were put out and a pet cock in the steam cylinder (the piston in which was working the pump) was opened. At a safe distance—sufficient to prevent being scalded—I thrust my hand into the escaping steam. Instantly the ends of my fingers became illuminated. A whiskered man allowed the steam to blow in his face and hair, when electric sparks were seen all over his head and were sufficiently numerous and strong to light up the visage, the beard and hair seeming to be on fire. This phenomena is explained on the theory that the piston and cylinder, while having no direct connection with the water in the well, the whole machinery is connected by the iron tubing, through which the electric current from the water passes into the cylinder and is emitted with the escaping steam."

THE PENALTY OF SUCCESS.

"Did you ever see the wife of a successful man?" I am tempted to ask, when some one points out to me the shining lights of these two friends of mine. Not that the men are brutal, ill-tempered, or exceptionally irritable; rather the reverse is true of them; they are amiable enough. Yet their unconquerable self-absorption has made them anything but boon companions. Their hours of labor or of research are prolonged unreasonably, with intervals of moodiness, sometimes of utter silence. The bubble they follow is ever dancing before their eyes; the fury of pursuit is all-in-all, and life apart from that has lost its charm. Their wives share in the triumph, of course, and why should they complain? They do not. Like the Dutchman's wife upon her death bed, they are resigned because they have to be. It is only between the lines of their patient faces that one may read the wish of the heart for the old days to come back when things were otherwise.—From "The Point of View," in August *Scribner*.

The Columbian Exposition is over a year-and-half ahead, it is true, but that space of time will soon be gone in this age of rapidity, and the Fair will soon be open.

CORRESPONDENCE.

Michael J. Dunn, Re-Instated.

To the Editor of the American Engineer:

Sir:—At our regular meeting, held last night, Michael J. Dunu settled his back dues, and was re-instated; and the council made an apology, as he said that he was not notified of his arrears.

C. A. Halbritter, Chief Engr.
W. A. Gleave, Cor. Engr.
John E. Sweet Council, No. 6, N. Y.

Syracuse, Aug. 1, 1891.

WHAT ARE THEY DOING?

To make any advancemeut in life, be it financially, intellectually, or mechanically, that one essential, *time*, is valued the most. It is used with economy and methodically.

Futures are looked to with a great deal of uncertainty, with anticipation that all will end well. The student, in his line, has thoughts of making a distinctive mark in his profession, visions of being authority on subjects pertaining to his business, success in all his undertakings, etc., but hardly ever a thought of when would his usefulness cease; the latter is of very rare occurrence. To those students, progress is everything to them. Disappointments or failures are only stimulants to renew their energies. The ordinary pleasures of life die to them trivial and too light to indulge iu; they become eventually the representative men in their line, and geuerally, after a life of usefullness, they retire on a competency enough to gratify all their wants,

The above class are in the minority, but are fouud in all lines of professions and vocations. Engineers who have trained their minds to adopt those methods, or tastes, are always found at the head of the profession and holding the best positions. Their conversation, topics, and dictations are always a sure indication of what they have done.

Those engineers who have favored procrastinatiou are, where? Still trying to make a start. Their inclinations and tastes are not in harmony with their work, and a few moments in their company is enough to prove what line of thought they have. The thought of what they are doing occurred to me while reading letters from two of th.se latter class of operators. They show very plainly the cause of their still being always in the start, but never at the finish.

Specimens of their letters are as follow:—

Mr. Steve Kristee esq
Gran rapids Mitchigan

deer sir i am so glad to have the time to drop you a letter it is just like catching it ou the Fly or making a good score. When you was hear you spoke about them Brasces being cuvered with corusion and to clene them of. i don so. the curved end i culd not so well, but the but end is all OK Was out to the ball Game yesterday and it Was a fine Game Will have a good Game next Munday Cum shure Youre frend joe Stubble.

Mr Stephen cristy

excuse my bad riteng you no how hard it is for to keep a good hand because i cant find the time to keep up with the practice When i was at school i always was ahed in my clas in spellin and riteing but cinse i am engineerin i cant spare the time. Well i was out to Camp sinse you was hear and had a good time lots of huntin and a very good fishin am goin to buy me another gun have bot the 2 bedle houns of Grassy i can show you a good lay out when you cum agin have not had time to reed your booke you gave me yet i fele to tired to rite yours in repecs

Si Moore

These specimen letters answer the question, What are they doing? It would be well to enquire if there are many more following the profession of engineering who have no time to improve and practice; they may be in the majority. But you can find them, and without any effort; their plants will show it. Economy is beyond their comprehension; their pay is meagre, and hardly more than will buy them bait, amunition, or a seat in the ball game. They are always having business in the machine shop. You cannot find them belonging to an engineers' association; they are afraid to make an application for fear they will expose themselves, as they thiuk. It is not knowledge they want, it is pleasure. Should they be so fortunate as to get into these associations, where ideas are exchanged, and information gained, their attendance is made very conspicuous by long absence, their dues are always in arrears, although small; their *brains* are smaller; and they are usually mentioned as being connected with "Another Boiler Explosion; four lives lost, and three injured. *Cause of disaster unknown*! Yesterday at an early hour the boiler at D. E. Lays and Knowit's mill exploded with above results the cause is a mystery, as E. Dunit, the engineer, was always considered a very careful man; he had just started up the mill after making extensive repairs."

There is no mystery about it, if there is, it is only that there are not more of the kind; for it is the result that shows plainly what they have been doing.

Stephen Christie.

EXPLOSION OF A TRAMWAY BOILER.

The boiler of a tramway engine bursted at the Learoyd Bridge, Huddersfield, England, June 3, killiug one, half killing another, and injuring several; and the pompous "investigation" which has since been held, as reported in *Engineering*, reveals the fact that "inspection" of boilers is no guarantee for their safety—not in Englaud at all events.

The boiler in question, known as No. 9, was of the vertical "Field" tube type, and, with the engine, was made in 1885 by Messrs. Black, Hawthorn & Co., Gateshead, for show at the Inventions Exhibition held that year. At the close of the Exhibition the engine was bought by the Huddersfield Corporatiou, and since its purchase the boiler has been at work on the tramway with slight intermission up to the day of the explosion. The shell was 6ft. high by 3ft. 9in. in diameter, made of one plate $\frac{1}{2}$in. thick, lap-jointed, and double-riveted at the vertical seam. The crown plate was flat, $\frac{3}{4}$in. thick, aud flanged downwards to the shell. The firebox, which contained seventy-nine "Field" tubes, was 3ft. 4$\frac{1}{2}$in. high by 3ft. in diameter, the original thickness being $\frac{7}{16}$in. The crowu plate was $\frac{7}{8}$in. thick. The firebox was welded at the vertical seam and was supported by two rows of 1in. screwed stud stays spaced about 12in. apart vertically and 9in. circumferentially. It was riveted to the shell at the base, a wrought-iron ring intervening. The uptake from the firebox crown to the shell crown was $\frac{1}{2}$in. thick, its diameter being 12in. at the top and 10in. at the bottom. The plates throughout the boiler were of iron. The boiler was provided with a manhole measuring 15in. by 12in. and three mudholes at the base 4$\frac{1}{2}$in. by 2$\frac{3}{4}$in. It was equipped with the usual fittings, iucluding two direct-acting spring-loaded safety valves, 2$\frac{3}{4}$in. in diameter, adjusted to 150lb., which was the ordinary working pressure.

At 8:30 on the morning of Wednesday, June 3, the engine had just taken the car to Learoyd Bridge, ou the outskirts of Huddersfield, and was standing in the public street, wheu the boiler burst with great violence. The firebox collapsed and rent circumferentially for a length of 28in. between the base ring and the lower row of stays, thereby forming an opening measuring 28in. in length by 20in. at the widest part. The car was forced backward about 30 yards, and the engine turned at right angles to the line of rails, while the firebars, cinders, and various small fragments were shot into the street. The windows in the neighborhood were broken, in one caso the furniture in the house being damaged; a man assisting the driver was killed, and thirteen persons who were passing or standing near at the time wore more or less injured.

The cause of the explosion was simple in the extreme, and one which, as is almost invariably the case, might easily have been prevented. The plate of the firebox was dangerously wasted by internal corrosion, and in places was reduced from its original thickness of $\frac{7}{16}$in. to as little as $\frac{1}{16}$in., the part where the rent occurred being from $\frac{1}{16}$in. to $\frac{3}{16}$in. thick. The corrosion was due to the acid properties of the feed water, which was drawn from the Blackmoorfoot reservoir. According to an analysis laid before the Commissioners the water contained acid equal to 0.6 grain of free sulphuric acid per gallon, and was thus unsuitable for the purpose for which it was used, being so likely to injuriously affect the plates

The bursted boiler had been examined, even the day before the explosion, when it "appeared" to be in "fair condition." The examiner sounded the plates with a hammer, but "there were no indications of weakness." On the same day, the Turnbridge Company sent a man at the request of the corporation to examine and sound the boiler, but his inspection did not appear to have revealed to him the fact that the boiler was in a dangerous condition.

The fact seems to be that those who were not supposed to know anything about a boiler, suspected the one in question to be unsafe, while the professional or expert engineers failed to find anything very wrong about it.

Mr. Pogson, manager of the tramways, said he was an engineer, and had been six years engaged with the corporation, who operate the street railways of Huddersfield. He was a member of the Institution of Mechanical Engineers. He had eighteen boilers under his charge, and when some of them were insured with the Yorkshire Company he had reports as to the internal corrosion, but he took no steps to ascertain the cause of that corrosion. The water was there and he had to use it, but as the corrosion became more marked an analysis was made. About half a cupful of an alkaline compound was put into the tank two or three times a week, but more could not be used as it produced priming. The pressures were increased all round to 150 lb. when the Kitson type of engine was introduced on the tramways. Repairs were carried out by men from the Turnbridge Boiler Works. He did not examine the boilers himself unless his attentiou was called to them. He relied on the insurance company's certificate of safety, but did not consider that it would relieve him entirely of the responsibility of further examination. The boilers were washed out every three weeks, and his foreman then examined them as to cleanliuess, but only once in two months as to their safety. An efficient examinatiou might have been made without taking out the firebox. In the case of five similar boilers the fireboxes had been renewed, after six years' working, on account of the corrosion and excessive wear and tear. The firebox of No. 9, which burst, had not been renewed. He never considered that boiler doubtful. After the explosion he noticed a good deal of wasting, and was surprised it had not been detected. If he had drilled the plate and found it only $\frac{3}{16}$in. thick, he should have stopped the boiler.

The Commissioners came to the conclusion that "brains were required to make a good boiler inspector." And the corporation (or what we would call in America, the city council), who owned the boiler, were fined forty pounds.

Commenting upon this case *Engineering* says: it suggests the question whether a new element of danger is being developed in those main streets and thoroughfares in which steam tramways are employed. In numerous instances, notably in the Midlands and in various parts of Yorkshire and Lancashire, the old method of horse traction has been superseded by steam traction with advantage in economy and speed. Hitherto, with the exception, unfortunately too frequent, of persons, consisting mainly of children, being run over and killed—a species of fatality practically unknown under the old system, but which is peculiarly liable to occur where steam-driveu cars pass quickly through populous districts—the steam tram has appareutly been free from danger to the general public. Several instances, however, have recently been investigated by the Board of Trade at Bradford, Leeds, Oldham Wolverhampton, aud other places in which the engiue drivers have been seriously or fatally injured by the bursting of the boiler tubes through wasting, while in one case a lad was killed from a similar cause just at the very moment he happened to jump upon the engine to speak to the attendant. In the official reports upon these explosious the Board of Trade have called attention to their frequent occurrence and to the fact that the subject deserves greater attention than it has hitherto received.

The Leeds (Eng.) Association of Engineers have moved to their new promises, at 5 Park Lane, Leeds. A paper on "oils" was read by Mr. B. Holgate, June 25, which was listened to with much interest. The lecture hall, reading rooms etc. are very commodious.

A WORD FOR OUR FRIENDS.

Owing to the amount of space required for recounting the proceedings of the Supreme Council meeting, and kindred topics, in the last two issues, we have been unable to give any special mention of the Manufacturers who so kindly took space and made splendid exhibits of their several lines of goods at the Alhambra Hall in Syracuse during said meeting. Nor shall we now only in a general way. We have already given a full list of the exhibitors, and called attention to the generous manner in which they met the deficit of the Jno. E. Sweet Council treasury—(owing to non fulfillment of agreement of several Manufacturers to take the space agreed to) which money was needed to carry out the programme of entertainment and pay hall rent.

But now, we would call attention to one important point in those exhibits. Every manufacturer, who sent his goods there, was fully aware that they would be subject to the scrutiny of practical engineers, which fact speaks volumes for those gentlemen. It shows a confidence, born of honest purpose, in their goods, that should not be lightly passed. In talking with a manufacturer the other day, he said he dreaded approaching a practical mechanic more than any other man in selling his goods, for, said he, it is then not so much price as quality which brings the business, and he feared, that while his goods were honestly put before the public, they might not be just up to the standard in the practical mind of a first-class engineer. This we say speaks volumes for those exhibitors, and we bespeak for them all the patronage that can be given, all things being equal. If engineers would look at this matter in a proper sense, they will readily see that a steady improvement will be made by manufacturers in steam goods, and a consequent added respect will ensue both from the manufacturer and the employer, provided they make it a point to keep posted.

Advertisements appear on other pages of those exhibitors at Syracuse, and we would advise writing for their catalogues and other printed matter, which we have no doubt will be cheerfully sent.

TRANSFER OF POWER BY ELECTRICITY.

BY DR. H. LUX.*

The problem of the transfer and distribution of power, at this period, can scarcely be deemed of less economic importance than was the application of power itself. The importance of the problem may be seen at a glance if one only considers the incalculable horse-power of the Niagara Falls, or of the ocean in its changes between ebb and flow. The successful achievement of the transfer and economic application of the forces of nature would bring about a complete revolution of industrial conditions. The practical application of the principle which was exhibited at Frankfurt an Main on May 15th was simply as follows:

In a machine so constructed that wire from insulated spools can be led over magnetic poles, an electric current is generated whose intensity and strian is dependent on the speed of the rotation and the power employed. The electric current thus generated is connected by two strong wires with a second machine of similar construction, the wire spools of which are set in motion by the electric current from the first machine. Theoretically it should now be possible to get as much power from the secondary dynamo as was employed in generating the current in the first or primary dynamo.

The explanation is, that an electric current being guided into a dynamo at rest will set its armature in rotation, and as the distance between the two dynamos, the generator and receiver, does not affect the result, the dynamo would appear to be an unexcelled apparatus for the transfer of power. And in fact no other method of transferring power can rival the electric system. The electric conductors can be laid in the most out-of-the-way places; they can be sunk as insulated cables in the earth, or in river beds or they can be carried on poles like telegraph wires by the aid of non-conductors, to the place where the second dynamo is to be employed in driving the labor machine.

* Translation in *The Literary Digest* from *Vom Fels zum Meer* for May.

This capacity of the electric dynamo to transmit power by means of insulated wires, up hill and down, renders it eminently adapted for employment in mines, tunnels, and other works in the mountains especially in the operation of wire tramways, on which principle a postal line between Monte Video and Buenos Ayres has been already designed.

Speaking generally, the dynamo machine can be employed for all purposes for which steam and gas motors are at present employed, and with many enormous advantages. There are no boilers to heat, no waste of gas, it is ready for work at any moment. The electric current is drawn from electric works where electricity is stored in enormous quantities, and supplied cheaply; and, finally, with one touch of the hand the motor is set in operation. The amount of electricity employed is precisely proportioned to the labor performed, and, what is of prime importance, the electric motor, in relation to the importance of the work performed, is very easily operated. As regards the dreaded danger of powerful currents, this can be so thoroughly guarded against by transformers and accumulators, that it is really freer from danger than gas or steam.

Of chief interest for the general public is the application of electric motors to the operation of street railway cars, a system which is already rapidly coming into use.

And now as to the economic importance of this transfer of electrical force.

There are two primary sources of power on earth: The sun's heat stored up in wood and coal which we convert into steam; a very imperfect method inasmuch as from the imperfection of our machinery five-sixths of the actual power stored in the combustible is wasted. Moreover, this source of power must be carried to the place where it is intended to utilize it. The second source of power is the force generated by the rivers in their course, by the ebb and flow of the tides of the ocean, by the winds. The utilization of these forces by means of dynamos in the manner above described has already had practical effect given to it on the small scale, but the method is now awaiting its crucial test at Frankfrut an Main, where arrangements have been made for the transfer of 300 horse-power from the Neckar. And as the system is operating satisfactorily on a smaller scale in many places in Switzerland, no doubt is entertained as to the success of this first experiment on a large scale. Should it work as satisfactorily as is expected, it will not be long ere the Falls of Niagara will be put into harness to drive the machinery of New York and Chicago. The French, too, have planned works at Havre for utilizing the ebb and flow of the tide to work turbine wheels which will transfer the power generated, to dynames, from which it will be conveyed by wire to Paris for motor and lighting purposes.

The influence which this use of the vast forces of nature will exercise upon social and industrial conditions, will be more apparent when we realize that it has other applications than the mere transport of motive power. The present condition of science leaves no doubt that any one form of motion can be transformed into any other desired form; all the forces of nature, into heat, light and mechanical power, as well as into electricity, and any one of these forms of motion into any other. Electricity is the form of motion most convenient for transfer into other forms, and with that at his command the possibilities of man's achievements transcend the dreams of fable and imagination. "Electra" is the fairy whose magic wand is already in motion, rearing pillar on pillar of the stately palace on which humanity shall sit enthroned, with all the forces of nature obedient to his behest.

CORN AS AN ARTICLE OF FOOD.

Corn as an article of human food attracted but little attention outside the United States until brought before the world by the successive Corn Palace festivals of the past four years. It was largely with this object in view that the annual Sioux City Corn Palace Festival was inaugurated. Its effects in this particular line have awakened the world. All America and Europe have heard of the Sioux City Corn Palace. A feature of the Paris exposition was a corn palace, decorated after designs furnished by artists in Sioux City. The many uses of maize were for the first time shown the people of Europe. At Edinburg, Scotland, Chas. J. Murphy, of America, spent several months in endeavoring to educate that country to the use of American Indian corn as an article of food. The traveled man has observed the little variety of food there is to choose from. The white bread for the rich man in Germany, Belgium and other European countries, black bread for the peasant, man and beast sharing alike, are the two single varieties of breadstuffs found. That the United States can supply any foreign demand for corn, no one will dispute. Iowa as the banner corn state has every reason to be foremost in the advocacy of corn as an article of food, and to this end the Corn Palace idea is perpetuated, and results in great benefit to the corn-producing countries of this nation.

The great feature in connection with the Fifth Annual Corn Palace festival, which opens at Sioux City, Oct. 1, and closes Oct. 17, will be the Military Mexican Band, which is absolutely and unequivocally the star musical organization of America. The great band is under the direction of the monarch of musicians, Sig. E. Payen. The band numbers 56 musicians and will give concerts in the Palace each afternoon and evening.

THE BOILER SUSPECTED.

One of Chicago's largest stores, that of Siegel, Cooper & Co., was burned to the ground, destroying property valued at about one million dollars, last Monday. Fortunately the fire broke forth at 7 a. m., before many of the employees had come there. The fire occurred just above the boiler, and it is "supposed" that it was a case of spontaneous combustion, arising from the heat of the boiler.

SCALDED WHILE CLEANING A BOILER.

John Wagoner was terribly scalded—almost cooked alive—while cleaning a boiler at Columbus, Ind., last Sunday morning. He was at work cleaning a boiler in the large cerealine mills at that place. About 10 o'clock another boiler close by bursted, and emptied a large volume of steam into the boiler in which he was at work. His fellow-workmen rescued him as promptly as possible, but not until he was so badly scalded that he lost the sight of both his eyes, and death may follow.

HEAVILY LOADED BUILDINGS.

At a recent meeting of the Civil Engineers' Club of Cleveland, O., Mr. James Ritchie read a paper describing a design for a built plate girder to span a 60-foot store front and carry the floors above of a heavily loaded building. The depth of the girder is the height of the second story and has openings in the web so that ordinary windows are not interfered with. The main difficulty is the transmission of shear on account of the web being interrupted by the window openings. This is overcome by forming the bottom flange partly of a 42″ plate securely riveted at the pilasters so that the load concentrated there is transmitted through the rivets and the 42″ plate as if the latter were the full depth of web.

AN ENGINEER'S DEVILISH WIFE.

William Cunningham is the name of the engineer who runs the hoisting engine at the new Masonic temple, Chicago. At least he did run it until last Monday night, and will soon be able to attend to it again.

As he was leaving work Monday night, he was met by his wife who ran towards him with a bottle of vitriol (which she kept behind her until close enough) and she threw some drops of the fiery liquid onto his face, and then ran away. Fortunately she was so excited and in such a great hurry that only a few drops came from the bottle, and the man's injuries are not dangerous. But as it was, his agony was terrible until he received medic l aid. Some of the vitriol dropped on his shirt, and soon burned through to the skin. Some fell on his hands also.

It seems Cunningham married a woman who was not a helpmate for him. He applied for a divorce recently; but although she did not seem to like William, she hated the idea of any other woman

having him, and she threatened to do him some harm if he did not abandon his divorce proceedings. She had not decided what to do, probably, until a certain Mrs. Paul threw some vitriol on a fellow who had assaulted her, she said. And then Mrs. Cunningham caught up the idea, and thought she would spoil William's beauty; but she overdid it.—she was in such a violent hurry that the vitriol had no time to get out, except a few drops.

THE NEW STANDARD DICTIONARY.

The Standard Dictionary of the English Language, on which over a hundred editors, comprising the most capable men in the various departments of learning, are diligently working, promises to reach nearer perfection than anything yet achieved in that line, The Century Dictionary and Webster's International will have to take back seats, and all the rest are nowhere, as Macaulay would have said.

The Standard will contain about 200,000 words, which will be about 70,000 more than in any other dictionary. And over 4,000 illustrations have been made specially for the Standhrd. A system of grouping adopted in this dictionary shows at a glance all the words belonging to any particular article or trade. Take the word *apple*, for instance. The Standard Dictionary gives the names (with full description) of 368 varieties, whereas Webster's International Dictionary has fewer than 40, and the Century (to end of Vol. V.) less than 30. The tabulated list of apples in the Standard contains a wonderful amount of information, as shown in the specimen pages which we have received.

Our friend Dr. Grimshaw, whose name is familiar to every steam engineer, is the editor in charge of handicraft terms. And the way the word *plumbing* is treated, affords a good idea of the character of the Standard Dictionary.

Plumbing. The first description given is that *plumbing* is, (1) the art or trade of putting in the tanks, pipes, traps, fittings, and fixtures, for conveying water, gas, and sewage, in buildings; originally the general art or trade of lead working, including, besides the operations before mentioned, making, putting up, and repairing, leaden roof coverings and window mountings. (2.) The pipe system for conveying water, gas, sewage, etc., in a building. (3.) The putting in or repairing of the water, gas, and sewage systems, in buildings. The second definition of *plumbing* shows that it means testing whether a wall or any object is vertical. Third, the sounding of the depth of a body of water. Fourth, the sounding or searching in mines.

The word in all its senses comes from the Latin *plumbum*, lead. According to the first definition, it takes its meaning from the fact that nearly all tanks, water pipes, and sewage pipes were originally of lead, as were also a considerable portion of large roofs, and the fastenings of window panes; so that plumbing was properly lead working. As defined under the other definitions, its meanings originate in the common choice of lead for the weight or bob used in determining the verticality of a wall or the depth of a hole or of a body of water.

LIST OF TERMS USED IN PLUMPING.

Including kindred trades, as gas and steam fitting.)

adapter
afterwash cistern
air chamber
air cock
alligator wrench
angle check-valve
angle cock
angle pressure-valve
angle valve
autogenous soldering
back-pressure valve
bag trap
ball and socket pipe
ball valve
basin cock
basin grate
basin plug
basin stopper
basin trap
basin waste
basin wrench
bat
bath
bath-boiler union
bath cock
bathtub
bathtub strainer
beak iron
beam hook
bell
bell trap
bending iron
bevel hub
bib
bib cock
bidet
bidet pan
blank flange
blow down
block joint
block-tin pipe
blown joint
blow-off cock
blow-off hose-cock
boiler
box coil
box valve
bracket cock
branch
branch tee
bulkhead union
bushing
caulking iron
came
cap
ceiling plate
cesspool trap
check valve
chipping knife
circulation coil
circulation stove
cistern
cleaning hydrant
cleaning valve
close nipple
closet cistern
cock
collar
combination bath-cock
compression ball-cock
compression cock
compression valve
cone joint
conical valve
copper bit
copper-bit joint
copper boiler
corner valve
corporation stop
counter cock
crease
creasing tool
cross
cross valve
curve
cutting-out knife
diaphragm valve
die
differential - screw pipe-joint
dinged work
dip tray
double-bell pipe
double connecting section
double-face valve
double fire-cock
double half - Y branch
double hub
double-hub bend
double seam
double valve
double-Y branch
drain cock
drain grate
drain pipe
draw-off cock
dresser
drip
drip pipe
drip tray
drop elbow
drop tee
dummy
Dutch clinker
Dutch tile
eaves trough
eel pump
ejector faucet
elbow
ell
equilibrium valve
expansion hanger
expansion joint
faucet
ferrule
fire hydrant
fire plug
flagging
flange
flange coupling
flange pipe
flange taft joint
flange union
flashing
float valve
floor chisel
floor plate
flush
flush box
flushing box
flushing-rim hopper
foottub
foot valve
45° elbow
fourway cock
frost valve
fullway valve
gage cock
galvanized iron boilers
gas bath
gas-drip box
gasket iron
gas pipe
gas soldering-apparatus
gas trap
gas valve
gate valve
gland
gland cock
glaze
globe valve
goose neck
ground cock
groze
grozing iron
gulley trap
half-S hopper trap
half-S trap
half trap
half-Y branch
hand hole trap
hand iron
hatchet bolt
H branch
hip tub
hook plate
hopper
hopper closet
hopper cock
horizontal check-valve
hose
hose bib
hose carriage
hose cart
hose clamp
hose coupling
hose nipple
hose pipe
hose screw
hose sprinkler
hose union
hose-union cap
hose wrench
hub
hydrant
hydrant cock
hydrant nozzle
hydrant suction
hydrant valve
hydrostatic joint
increaser
internal joint
inverted Y
killed spirits
L
lateral branch
latrine
latterkin
laundry tubs
leaden pipe
leader
lever and cam
lever faucet
lever-handle cock
liquor cock
lock cock
lock faucet
long Y branch
main
molasses gate
mushroom strainer
nipple
nozzle
offset
offset pipe
oil
one-eighth bend
open return-bend
overcast
pan closet
pantry cock
pantry sink
pavement pipe
pendant cock
pet cock
pillar cock
pipe
pipe bender
pipe cleaner
pipe connection
pipe coupling
pipe covering
pipe die
pipefitters' vise
pipe fittings
pipe grip
pipe joint
pipe laying appa-ratus
pipe plug
pipe prover
pipe reducer
pipe-screwing
pipe stay
pipe stop
pipe-threading
pipe tongs
pipe turnbuckle
pipe union
pipe vise
pitcher nose
planish
planishing iron
plug
plug basin
plug cock
plug valve
pneumatic tube joint
pouring stick
P trap
punch
putty joint
quarter bend
quarter turn goose-neck
racking cock
racking faucet
radiator
rain and well water stop
raise
raising hammer
reducer
reducing coupling
reducing tee
reflux valve
regulating valve
retaining valve
return bend
return-bend back-outlet
return valve
revolving cock
ring hook
ring valve
riser
riser pipe
rivet
riveting hammer
rivet set
rolled joint
rose
rough stop
rough work
rounding cock
round iron
running trap
sanitary T branch
screw-down cock
screw-down stop-cock
screw-down valve
screw valve
seal
seam
seaming tool
seam set
self-closing faucet
service box
service cock
set basin
set tub
sewer-gas check
sewer-gas trap
sewer trap
shave
shave hook
shears
sheet copper
sheet lead
sheet-metal press
S hopper trap
short hopper
shower bath
side-edge
side Y
sink
sink pipe
sink plug
sink trap
siphon closet
siphon trap
sleeve
slide valve
sliding valve
slope-branch joint
snarl
snarling iron
snip
socket pipe
soil
soil branch
soil cup
soil pipe
solder
soldering iron
soldering nipple
soldering tool
soldering union
solder mold
spigot
spinning metal
spring compression cock
spud
stage joint
stake
steam valve
stench trap
stop valve
straight cock
straight valve
straightway valve
strainer
strainer foot-valve
S trap
street-washer
street-washer check
strike up
striking-up press
stuffing cock
suction basket
suction butt
swinging coupling
swinging valve
swing joint
T
tack
tack mold
taft joint
tail pipe
tank check-valve
tap
tap borer
taper screw joint
tap-hole protector
tapping cock
tasting cock
T branch
tee
teest
telegraph cock
telegraph faucet
test plug
T handle
thimble
three-quarter S trap
threeway cock
throttle damper
tide flap
tin
tin-lined pipe
tip-up basin
trap
trap mold
tub
tube valve
turn pin
twin safety-valve
underhand joint
union
vacuum valve
valve
vertical check-valve
washbasin
washbasin stand
washer cutter
washout closet
washstand
washtub waste
waste
waste nut
waste preventer
waste stopcock
wasteway
water-back coupling
watercloset
water gate
water main
water pipe
water ram
water shoes
water valve
wedge valve
weighted gage-cock
wiped joint
wiping cloth
wiring stand
wrought iron pipe
wye
Y
Y bend
Y branch
Y cross
yoke

Phrases and compound words in the foregoing list are defined under the principal word therein, which may be seen in its regular alphabetical place.

Every other word is treated in a similar way—fully, exhaustively, and clearly. This grouping of words belonging to one trade is a great convenience to enable one to find the word he wants. Then in the regular alphabetical list of words each particular word is fully defined, and the way to pronounce it clearly shown.

The Standard Dictionary will be a great library in itself. And it will be worth while to buy it at the advantageous terms now offered by the publishers, Funk & Wagnalls, 18 Aston Place, New York. The price of it after it is published (which will not be before next January) will be $12, strongly bound in a single volume. It will also be issued in two volumes (for convenience of handling, and so that the binding will last longer) at $14. But to those who will order the book before hand,—say before the end of September—the price is only $7, on these conditions, namely, that the following blank, or a copy of it, be filled up and sent to the publishers, together with *one dollar* on account; the balance ($6) to be paid when the book is ready to be delivered. Bound in two volumes, the price will be $2 more.

AMERICAN ENGINEERS' ACCEPTANCE BLANK.

To MESSRS. FUNK & WAGNALLS, 18 and 20 Astor Place, New York:

I accept your offer for a copy of your Standard Dictionary of the English Language, and herewith enclose $1 in advance payment for the same, and will forward you the remaining SIX DOLLARS when you notify me that it is ready. It is understood that, if I am not satisfied with the work, I shall be at liberty to send it back within three days, and you will return my money.

Date.....
Signed.....
Number and Street.....
City or P. O.....
State.....

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Tourist tickets are now on sale, and can be had of ticket agents of all roads and at Burlington Route depots in Chicago, Peoria and St. Louis.

There is no better place than Colorado for those seeking rest and pleasure.

PHOTO OF THE DELEGATES.

The Wheeler and Tappan Co. have received the photographs of the delegates, which they procured at Syracuse, and will send a framed one to every council of the A. O. S. E. for the council chambers.

Individual members of the Order, who wish to obtain copies of this interesting photo can have one by sending 40 cents in 2-cent stamps or postal note, to the office of the Wheeler and Tappan Co., 12 and 14 South Jefferson street, Chicago, Ill.

WORLD'S FAIR NOTES.

James Allison of Cincinnati has been chosen Chief of the Department of Manufactures, and Willard A. Smith Chief of the Department of Transportation. Prof. W. L. Tomlins has been commissioned Chief Director of the Exposition.

Prof. Tomlins, Choral Director of the Exposition, is in England and will invite a number of the great English choral societies to participate in the dedication ceremonies of the Exposition buildings in October, 1892. The auditorium for choral music has been located in the north court of the manufactures building.

Texas has decided to set apart a spacious room in its Exposition building for an exhibit by the colored people of the state.

Alabama may be represented in miniature at the Exposition by a series of comprehensive relief maps. A man at Mobile has brought out this scheme and proposes to show the mineral deposits, cotton belt, vegetable farms and everything else of interest in

the state on a series of maps covering 20,000 square feet.

Commissioner Capt. G. P. Cotton, who is now at San Pedro Sula, Honduras, stirring up interest in the World's Fair, has secured a collection of over 400 varieties of birds, some of which are quite unknown to the outside world, which will be exhibited with other products of Honduras. The extraordinary collection of butterflies and insects will not be far behind, and arrangements have been made to forward a fine selection of orchids to Chicago at an early date, so that they may be growing and blooming there in 1893.

In the city of Leipsic, Germany, thirty-four firms have declared their intention of participating in the Columbian Exposition. At a meeting of the Cologne (Germany) Board of Trade, June 30th, a resolution was adopted asking the Imperial Commissioner for the Columbian Exposition to get estimates from Chicago from responsible firms for showcases, etc., in order to enable exhibitors to figure more closely the probable expenses of exhibiting.

George Ward, manager of the Commercial Cable Company, writes to Chief Barrett that he will make a big display at the Exposition of cable instruments. He is expected to show a complete repairing steamer, illustrating the method of repairing cables.

The London *Times*, in a long review of the Exposition, says there can be no doubt now that the Exposition will surpass in many respects all expositions previously held. English manufacturers are urged to make large displays.

The New Orleans Machinery Company writes to Chief Buchanan that it will make a complete exhibit of cotton gins, sugar mills and other machinery at the Exposition. Another interesting invention that this company will bring is the first cotton gin made by Eli Whitney, which was invented some time in 1790.

The general auxiliary committee on agriculture congresses has issued an address to the agriculturists of the country. This auxiliary congress will include representatives of farmers' organizations, agricultural colleges and state boards of agriculture. The subjects to be considered embrace every branch of farm life. The local committee will be assisted in its work by a large advisory board to be selected from various countries.

The art department has issued its rules for exhibitors, outlining the plan of the art exhibit. All works to be admitted must be originals, with the exception that casts from original works by modern artists are placed in the same class with original figures and groups in marble. There will be three sections in the department—an American section; a section for foreign countries that are represented by a commission; a section comprising private collections and the works of artists from countries not represented by a commission. All works must be examined by an official jury before they can be admitted. Progress in American art and architecture is to be a special feature of the exhibit.

The Wisconsin State building will be two stories high, with not less than 10,000 feet of floor space exclusive of porches. The whole structure is to be built of Wisconsin material. The exterior walls are to be of stone, brick, and terra cotta, and the roof of slate, tile or iron made in Wisconsin. The interior is to be ornamented and furnished with plate, beveled, and mirror glass, Wisconsin pine and hardwood, and encaustic tile. The cost of the building is estimated at $30,000. The commission has advertised for plans and offers a prize of $300 for the accepted design and $200 for the next in merit.

All of the important trunk lines in the United States have agreed to transport exhibits at half the usual rates. This reduction is made by the different traffic associations. It applies to every class of exhibits except fancy horses, cattle and other high priced animals. The latest traffic association to grant the half rate is the Trans-continental, an association that embraces all lines west of the Mississippi River. Similar action has already been taken by the Western Traffic Association, Trunk Line and New England Association.

Under the direction of Chief Burnham plans for two new buildings for the Exposition are being made. These buildings are for a shoe and leather exhibit, and for a musical display. They will be about 325 by 425 feet each, and each will cost $100,000. The location selected for them is in the grand court of the manufacturers and liberal arts building. It was the original intention to leave two great open courts in the center of the manufacture building, each about 400 by 500 feet. After the shoe and leather industries of the country made such a determined fight for the building and agreed to raise all the money necessary to put it up, Chief Burnham decided that the two buildings named could be erected in the courts which he had originally intended to decorate with flowers and fountains. The buildings will be one-story high and will be separated from the walls of the main building by streets about fifty feet wide.

IN FAVOR OF THE WORLD'S FAIR.

The Civil Engineers' Club of Cleveland recently passed the following resolution:

Resolved, That this Club heartily indorse the action of the General Committee of Engineering Societies, Columbian Exposition, so far as the work has progressed, and that we are in full sympathy with the work as set forth in the report of our representatives.

Map of the United States.

A large, handsome map of the United States, mounted and suitable for office or home use, is issued by the Burlington route. Copies will be mailed to any address on receipt of 12 cents in postage by P. S. Eustis, Gen'l Pass. Agent, C., B. & Q. R. R., Chicago, Ill.

CABLE ROADS.

An Engineer, perfectly conversant with the German system of cable-road construction, and owner of abundant material in finished rails, and all requisite tools and appliances, belonging to the business, seeks a connection with an appropriate firm for the building of cable-roads, on a basis of a salary and percentage. Address

Rudolf Mosse,
Dusseldorf, Germany.

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Electric Lighted and Steam Heated Vestibuled Trains, with Westinghouse Air Signals, between Chicago, St. Paul and Minneapolis, daily.

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Ticket Agents everywhere sell Tickets over the Chicago, Milwaukee and St. Paul Railway.

CONTRACTS OPEN.

Water-Works.—Sealed proposals will be received by the Chairman of the Water Supply Committee to build a system of water-works for this place, Gainesville, Fla., according to plans and specification on file. Bids will be received and opened on September 1, 1891. The committee reserves the right to reject any or all bids. For copies of plans and specifications and any further information address

A. J. McArthur, Chairman Water Supply Committee.

Steam Heating.—Sealed proposals addressed to A. P. Wooldridge, Secretary of Board of Regents of the University of Texas, will be received until 12 o'clock, noon, August 22, 1891, at Austin, Texas, for the erection of a steam heating plant for the university. Plans and specifications can be seen at office of Burt McDonald, at Austin, Tex., or they will be sent to bidders upon a deposit of $5, guaranteeing their return. Right is reserved to reject any or all bids and a certified check for $300 must accompany each bid.

Burt McDonald, Architect.

Water-Works.—Sealed proposals will be received until noon of Tuesday, August 18th, 1891, by the Trustees of Water-Works of Eaton, Ohio, for the following items for the Eaton Water-Works:

Eight hundred and sixty-five (865) tons of cast-iron water pipe, ranging from four (4) to twelve (12) inches diameter.

Thirty-two thousand nine hundred and five (32,905) pounds of special castings for above pipe.

Seventy-four (74) four (4) inch double-nozzle fire hydrants.

Fifty-nine (59) stop valves, from four (4) to twelve (12) inches diameter, and fifty-nine (59) stop boxes for above valves.

Laying of above pipe and setting of above special castings, fire hydrants, stop valves and stop boxes.

Brick pumping station and brick chimney.

Two (2) compound condensing, duplex, direct-acting pumping engines, each of seven hundred and fifty thousand (750,000) gallons daily capacity, together with two return tubular boilers and all appurtenances necessary to complete said machinery.

One (1) steel stand-pipe twenty (20) feet in diameter and eighty (80) feet high.

Ranged rubble foundation pier for stand-pipe.

Proposals must be made on the blank forms furnished by the Trustees of Water-Works, and all legal formalities must be complied with to secure consideration of the proposals.

The preliminary bond and date of furnishing materials and completion of work must be filed to constitute a formal proposal.

Plans of above work may be examined and blank forms of proposal and specifications can be obtained at the office of the Trustees of Water-Works, Eaton, Ohio, or the office of the Engineer, rooms 21, 22 Glenn Building, Cincinnati, Ohio.

The proposals must be sealed and addressed to the Trustees of Water-Works, Eaton, Ohio, and be indorsed with the name of the person, firm or corporation which makes the tender and be accompanied with certified checks payable to the order of the Trustees of Water-Works as follows:

Water pipe and special castings	$300
Fire hydrants	250
Stop valves	200
Pipe laying	300
Pumping station and chimney	200
Pumping machinery	300
Stand pipe	300
Stand pipe foundation	200

The Trustees of Water-Works reserve the right to reject any or all proposals.

Wm. O. McCabe, Herman Sanders, Andrew Heistand, Trustees of Water-Works, John W. Hill, Engineer, Cincinnati, Ohio.

Eaton, Ohio, July 20th, 1891.

Pumping Engine.—Sealed tenders will be received at the office of the Board of Water Commissioners, Woodstock, Ont., up to and including Saturday, Aug. 15, 1891;

1. For the furnishing and erection of a steam pumping engine of 2,000,000-gall. capacity.

2. The furnishing of pipe and laying of an 18-in. earthenware conduit about 17,000 ft. in length.

3. For furnishing hydrants and valves required in the distribution system.

Specifications and all information pertaining thereto can be obtained from the engineer, W. M. Davis, Woodstock.

The Board reserves the right to reject any or all bids.

All tenders to be addressed to the undersigned.

Geo. C. Eden, Sec'y of Board.

Water-Works.—Sealed proposals will be received by the City Council of the City of Washington, Washington County, Iowa, until 12 o'clock noon of the 17th day of August, 1891, for furnishing material and constructing water-works in said city.

The work to consist of a building, storage reservoir of 30,000 gallons capacity, one standpipe 14x110 feet, one artesian well pump, two duplex pumps, capacity of 600 gallons per minute each; two boilers, 50 horse power each; 380 tons cast-iron pipe, about 10 tons specials, 38 hydrants, 20 gate valves.

Bids will be received for the whole or any particular branch or subdivision of the work and materials at the option of the bidders.

Full drawings may be seen in the office of the City Clerk at Washington, Iowa, or in the office of Geo. W. Wynn, Consulting Engineer, at Cedar Rapids, Iowa.

For copies of specifications and form of proposals address J. J. Kellogg, City Clerk, Washington, Iowa.

The right to reject any or all bids is reserved.

J. G. Hise, Mayor. F. E. Lamphere, W. S. Reister, Frank Stewart, Aaron Hise, W. N. Hood, Water Committee.

Water-Conduit.—Sealed proposals will be received by the City of Savannah, office Water-Works, Savannah, Ga., until eleven (11) o'clock a. m., Aug. 26, 1891, for the construction of a Water Conduit of masonry, on masonry and timber, having an internal diameter of approximately six (6) feet and a length of three thousand (3,000) feet, more or less, all to be in accordance with general specifications on file in the Water Office at Savannah, Ga., or which, with other information, can be obtained from Thos. T. Johnston, Consulting Engineer, at Room 29, No. 171 La Salle St., Chicago, Ill. Proposals must be made in accordance with aforesaid general specifications. Proposals must be accompanied with a cash deposit of two thousand ($2,000) dollars or a certified check for two thousand ($2,000) dollars drawn in favor of the properly authorized agent of the City of Savannah, to be returned or retained in accordance with the general specifications. No proposal will be entertained unless the party furnishing it can offer evidence satisfactory to the Mayor and Board of Aldermen of the City of Savannah of his ability, and that he has the necessary facilities, together with pecuniary resources, to fulfill the conditions of the contract and the specifications, provided such contract should be awarded to him.

The right is reserved to reject any and all proposals not deemed to the best interests of the city.

James Manning, Superintendent.

AUGUST 15, 1891. **The American Engineer.** VOL. 22, NO. 7.

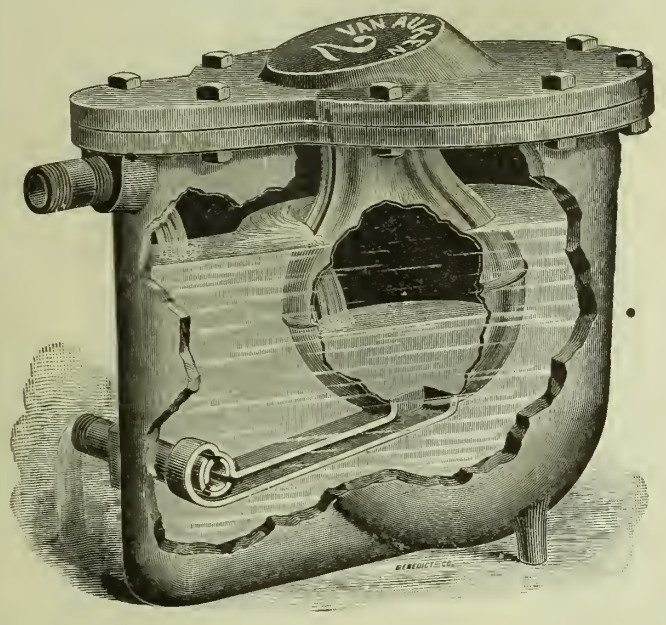
THE VAN AUKEN STEAM TRAP.

The illustration on the upper part of this page represents the Van Auken steam trap, manufactured and placed on the market by the enterprising firm, The Van Auken Steam Specialty Co., of Chicago. During the year or so that this company has been doing business in this great metropolis of the west, they have introduced several valuable steam specialties which have rapidly come into favor. And their steam trap, illustrated herewith, is characterized by the same simplicity of construction and originality of conception and design that mark the other Van Auken appliances.

The principle upon which the trap works radically differs from other inventions in the same line. And the Van Auken Company claim many important advantages for their device. "No one, so far, has succeeded in making a float that would remain tight for any great length of time," they say, "and if such a float was made heavy enough to withstand high pressure, it became so heavy that it was no longer a float."

In this trap the float is made to leak purposely, pains being taken to have the leak in the right place; and the pressure on the inside and outside of the float being the same, it does not have to be made exceptionally heavy to obtain strength.

Another difficulty with the older form of steam traps is that the area of the outlet is less than the inlet, it is said, and if the valve is overworked it becomes loaded and does not afford the requisite relief of piping to which it is attached. The construction of the Van Auken trap is simple. Aside from the case, or outer shell, there are only two pieces, the float and outer half of the outlet valve being in one piece, the inner half of the valve being the other. The float itself is made of spun copper, and to the bottom of the float a hard brass tube is brazed; at the other end of the tube is formed the outer half of the valve, the inner half being simply a prolongation of the tube projecting through the outer shell to the outer end of which the discharge pipe is attached.



The float is weighted sufficiently to insure its proper working and the action of the float is as follows: The water of condensation enters through the inlet and raises the float until it strikes the cap, in this position the outlet valve is closed; the water continues to enter the trap until it reaches a certain level when it enters the float through a slot or opening in its side; the float fills with water until it becomes heavy enough to sink and when it sinks it opens the outlet valve allowing the water to discharge. When at work the float sinks just far enough to allow the water to escape in a steady stream, just as fast as it enters the trap.

The area of the outlet pipe and passage from float to valve and the opening into float are made as large in area as the inlet opening; consequently the trap will discharge water as fast as it is received, even if it comes in a voluminous stream. The valve itself is balanced and, being made of hard brass, will not stick. Changes in pressure or temperature do not affect the working of the trap. There is ample room in the bottom for any sediment that may find its way therein, and a little blow off valve allows of the sediment being blown out without interfering with the working of the trap in the least. By taking off the cap, the float may be taken out and the trap cleaned.

Taken as a whole the device is one of the most ingenious and practical that has of late been brought to the attention of the steam using public.

ELECTRICITY SUPERSEDES STEAM.

All the machinery in the Crosby Steam Gauge Company's building on Oliver street is to be operated by electric motors. Heretofore a large engine in the basement ran all the supplied power for all shafts, etc., but by the proposed arrangement motors varying from 1 to 7½ horse-power will be put in each room to operate all the machinery therein. By this arrangement the work will be done much more expeditiously as well as at a less cost. Each room will be independent of all others for its power and there will be no waste by the running of unused shafting. All the motors will be connected directly with the circuit of the local Edison Company.—*Boston Commercial Bulletin.*

STRIKES ENDED.

Chain-makers at the Findlay (Ohio) Rolling Mills have gone to work after a strike of five weeks' duration. The Amalgamated Association demanded eleven advances in wages last June. The company conceded nine out of the eleven demands, but protested against the other two. Hence the strike, which was a fruitless one (worse than fruitless a great deal) as 79 men have at last resumed work on the very conditions against which they "struck." Boiler-makers of the Santa Fe shops at Topeka, Kans., have returned to work, all differences having been amicably settled.

The engineers of the "L" road at Kansas City, Mo., have resumed work. They are now working at a rate of $2.70 a day, and not by the hour. The settlement is exactly on the terms proposed by Chief Arthur of the Brotherhood of Locomotive Engineers. The committee of engineers waited on receiver D. N. Edgerton of the "L" road at his home and told him that they gave him a few minutes to decide one way or the other, to accept the proposition or deny it. He accepted it.

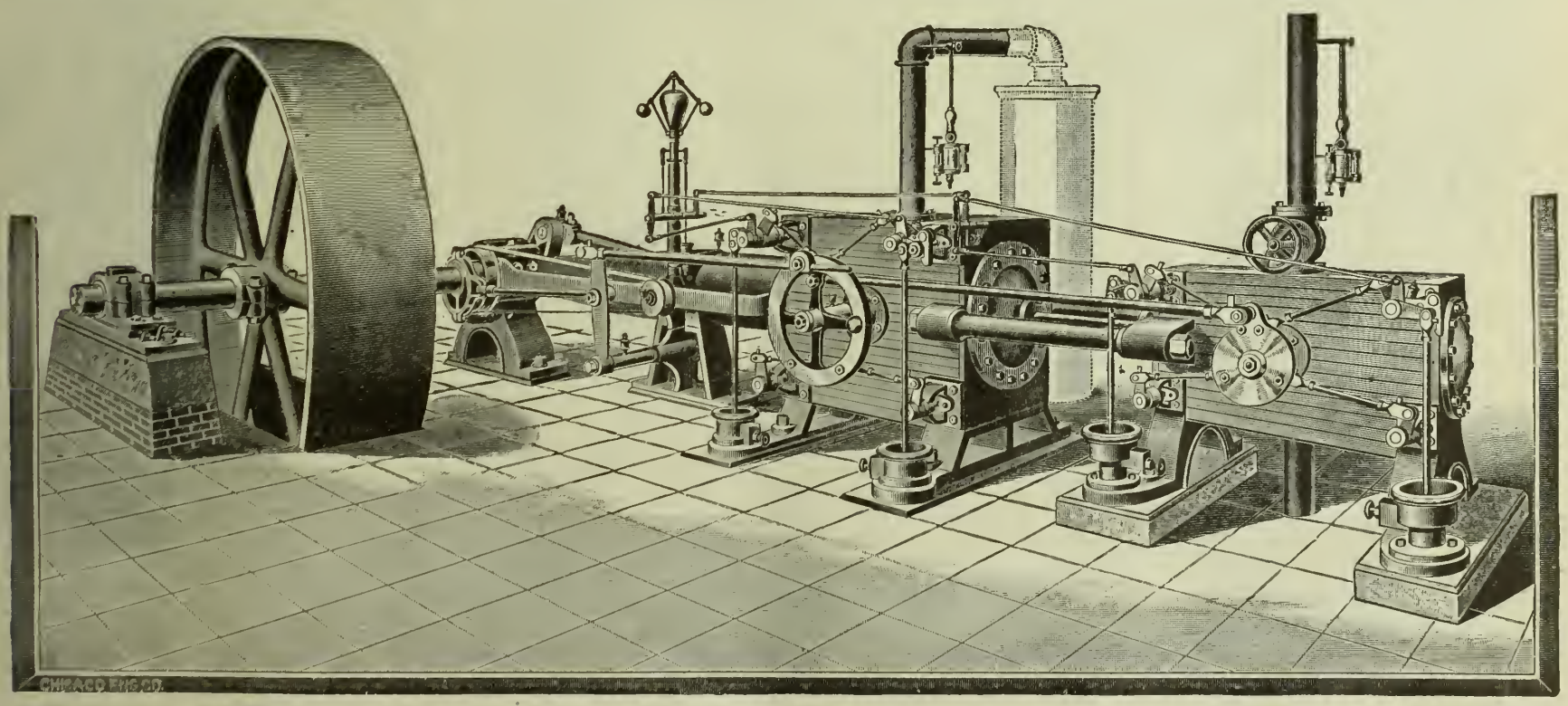
SIOUX CITY IMPROVED CORLISS ENGINE.

We herewith present a cut of the improved Sioux City Corliss engine which is rapidly coming into prominence in the western market, for general manufacturing, and for electric lighting and railway purposes.

Since re-designing their engine, and greatly increasing the weight and stiffness of their beds, cylinder feet and main bearing pedestals, this company have met with tokens of appreciation from the trade, hardly expected by them; and as is evident from the accompanying cut (across this page), the general design of this engine is excellent. Then they have one of the most improved hook valve gears on their engines, giving the most perfect distribution from nothing to the possible one-third cut-off. But of still greater importance is the close regulation of this engine. It is this principle that has built up its reputation rapidly.

This company have many engines working in electric lighting stations under a variation of less than 2% between extreme heavy and light loads. The close regulation is especially appreciated also by the electric railway trade, to whom the Sioux ity people have recently sold several large engines.

To improve this record of regulation still more, they are adding very greatly to the weight of their fly-wheel when used for electric railway driving, thereby insuring the very best possible regulation for that service. And their improvements in that direction seem to be appreciated.



MACHINE CUT SPUR GEAR.

Built by the Walker Manufacturing Co.

The cut of the gear shown herewith, represents a very large machine cut spur gear, made by the Walker Manufacturing Co., the well-known engineers and machinists of Cleveland, O., which was used, in conuection with a steel pinion, made by the same concern, on large pumping engines for removing water from one of the South Africa diamond mines. The dimensions of this gear were as follows: 192 teeth; 30′ 6.66″ pitch dia.; 30″ face; 6″ pitch; bore 27″; diameter of hub 9′ 2″; weight of hub being 15 tons, and the total weight of gear 66¾ tons.

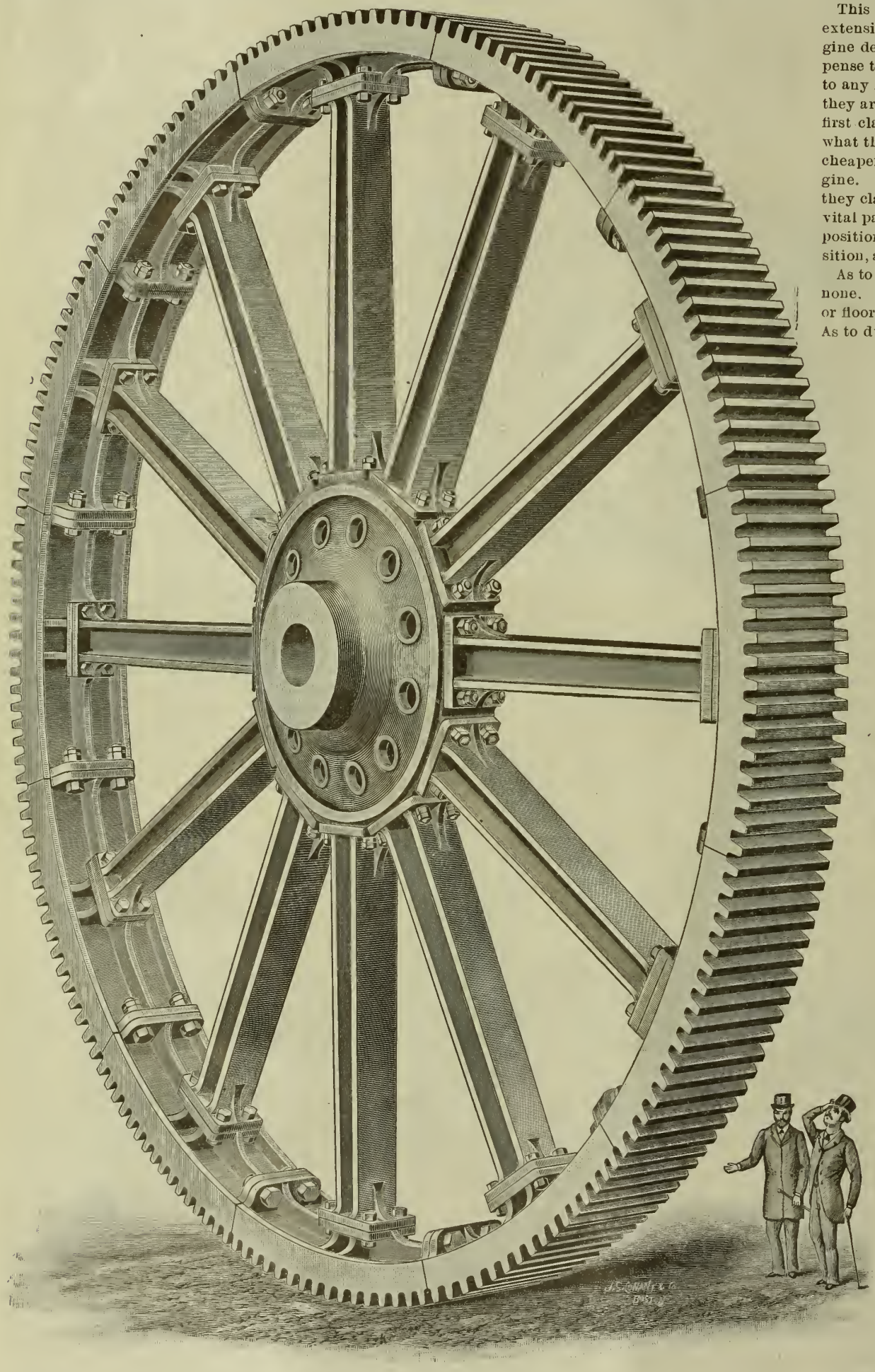
Some conception of the exactness required in the formation of this large wheel may be realized when we say that the owners, in order to provide for a possible breakage, which is most improbable, ordered one segment and one arm additioual, the requirements of which were that these parts might fill any position in the wheel.

The wheel was fitted up most carefully, and it presents a fine piece of machinery, as may be judged from the illustration.

This gear, with the steel pinion, was the only part of the massive pumping machinery which was made in this country, the balance of work being contracted for in England.

In reply to an inquiry as to why the gears had been singled out for manufacture at a different point than the rest of the machinery, the engineer of the company replied that he thought they could rely on getting a superior class of iron in America, and he knew they could secure as perfect work.

That man knew what he was talking about.



RACINE IMPROVED AUTOMATIC ENGINE.

The Racine Hardware Manufacturing Co., of Racine, Wis., are well known as manufacturers of steam yachts, sail and row boats, school and church furniture, steam pumping outfits, stationary and marine engines, and Pierce's automatic engines. The fine grey iron and brass turned out of their foundry is also in great favor.

This enterprising company, having lately made extensive additions and improvements in their engine department and having spared no time or expense to make their engines equal, if not superior to any high speed automatic engine that is made, they are now prepared to place on the market a first class automatic engine, guaranteed to be just what they say it is, and at a price that makes it cheaper than a common slide valve throttling engine. As an electric light engine it has no superior, they claim. The valve, cylinder and piston, (the vital parts of a steam engine) being in a vertical position, will outwear two lying in a horizontal position, as the manufacturers state.

As to compactuess, they maintain it is second to none. It does not require one-half the foundation or floor space that a horizontal engine requires. As to durability, no engine was ever designed (as they remark) that is as durable, as a well proportioned vertical engine. They are easy to handle and much easier to keep in line than a horizontal. This engine, of which the cut in this column is an illustration, has a solid steel center crank shaft and is made to carry one, two or even three pulleys if desired. Where two pulleys are used, they are generally placed both on the same side of engine. The governor pulley next to the frame and the outer bearing, and a light driving pulley outside of outer bearing; this makes an exceedingly handy and compact arrangement.

The crank pin is lubricated from the outside by a solid oil cup, which revolves with the shafts; but it can easily be taken off and filled while the engine isin motion. By this device it is almost impossible to have a hot crank pin.

The crank bearings are of extra leugth, and babbitted with hard genuine babbitt.

The connecting rod is made of steel in "T" shape, for lightness and strength, and has adjustable bronze boxes at both ends.

The guides for cross head are of extra width and length, and cast solid with the frame. The cross

head shoes are bronze, and are adjustable and are so designed that they can never become loose or get out of place.

The valve is, in its chief essentials, the same as used on a number of the best high speed automatic engines in the market. It is very simple and perfectly balanced.

Both the valve and steam chest are made from a very hard close grade iron, and great care is taken in fitting. The steam chest has an auxiliary exhaust port for the crank end of cylinder, and in larger sizes the valve chamber is jacketed with exhaust steam.

The governor is exceedingly simple, and has absolute control of the engine at all times, under varying loads and steam pressure, with a variation not over two per cent between load and no load.

These engines are made in sizes from 1 to 100 h.p. A 100 h.p., 2 pulleys, requiring a floor space of only 60x84 inches. Above 15 h.p. they are self-contained.

Those who wish to know prices, or obtain further information, should write to the company as above.

THE PRODUCTION OF ALUMINIUM.

The commercial production of aluminium is no longer an experiment, and tons of it are now made for each ounce of a few years ago. It has long been known that this curious metal is one of the most plentiful in nature; but owing to the difficulty in separating it from its combinations, aluminium has been classed among the precious metals.

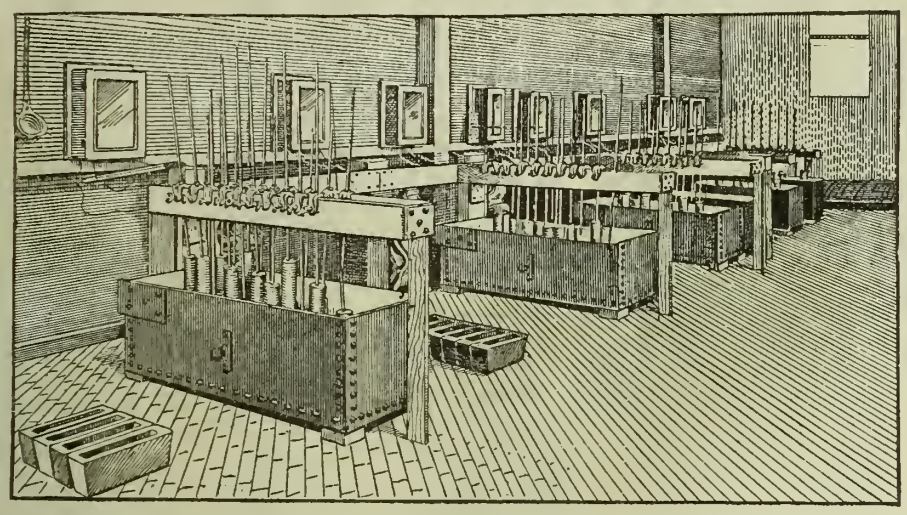


Fig. 1. Aluminium Reducing Baths.

With the invention of the Cowles' process of electric reduction, and its further improvement by the Pittsburgh Reduction Company, the price has fallen to less than one-tenth of the current rate prior to these inventions.

The output of metal increases rapidly and constantly with its appreciation by manufacturers.

The ore to be reduced is an imported oxide of aluminium, and the medium for the solution and electric current is a melted triple fluoride kept at a red heat by its resistance to the current. Both poles are of carbon—the negative being a carbon-lined iron tank, and the positive a series of iron rods tipped with carbon, which is consumed gradually by the negative element of the ore. A curious feature of the process is the constant character of the fluoride bath, which remains unchanged no matter how long used. Only a moderate pressure of ten volts is required to break the chemical union, but the quantity of metal deposited is directly proportioned to the amperes of current.

The Pittsburgh Reduction Company's commercial success is dependent in a great measure on their ability to run the plant continuously for a long time. Recognizing the single-acting principle of the Westinghouse engine, as best suited for their purpose, they have installed two Westinghouse high-duty compound engines of 200 h.p. each, which drive two Westinghouse shunt-wound dynamos in multiple arc, each generating 2,500 amperes of current of 50 volts pressure; also 1 Westinghouse standard 125 h.p. engine driving two Westinghouse shunt-wound dynamos multiple arc, each generating 1,000 amperes of current of 25 volts pressure.

In the short time that this company has been organized, a four months' run has not been uncommon, and it is quite probable that the machinery will be called upon in the near future to run for a year without a stop.

Figure 1 conveys a clear idea of the construction and arrangement of the reducing baths.

Figure 2 is a view of the interior of the company's power-room from a photograph.

The increase by Dec. 31, cannot be conjectured.

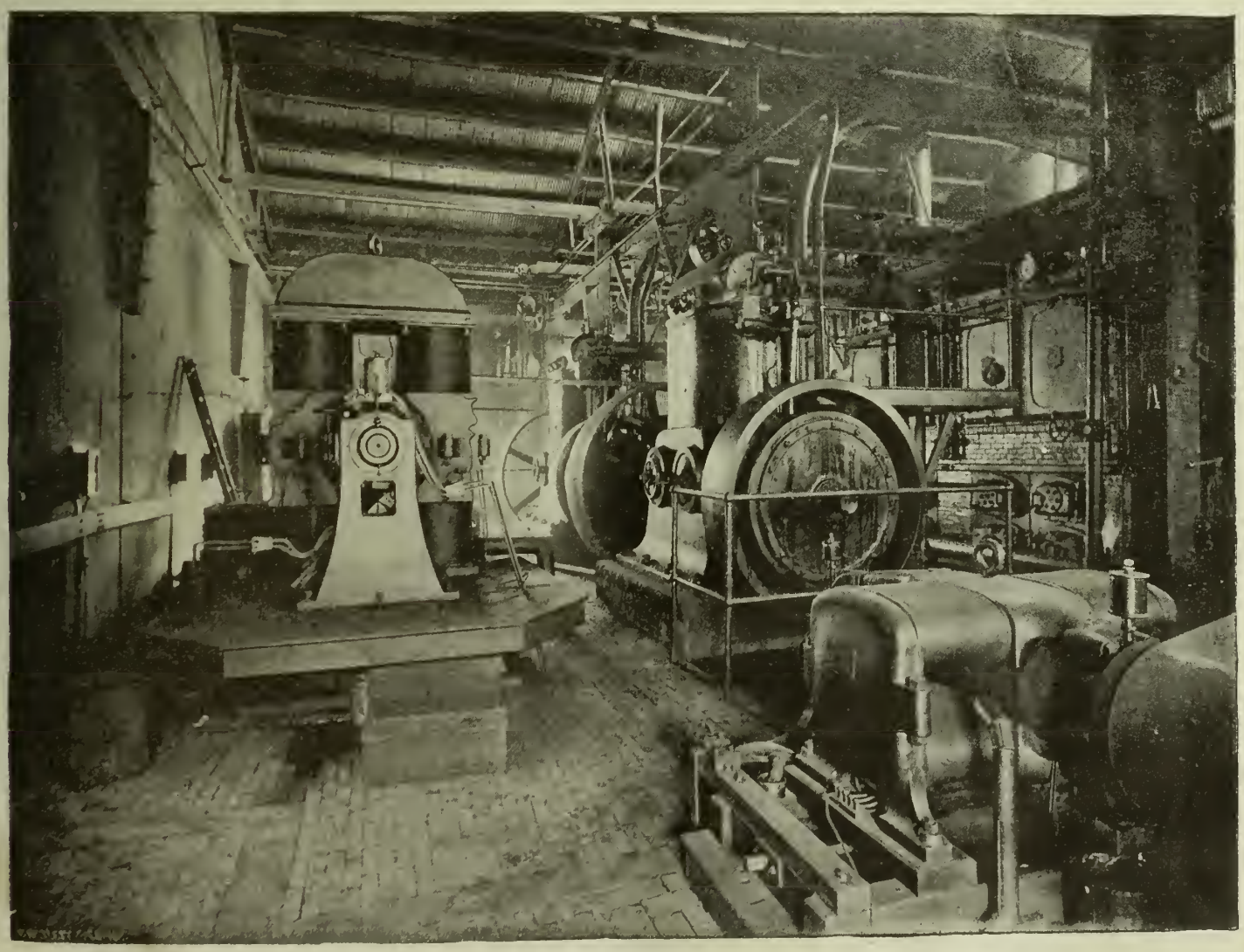


Fig. 2. Power Room of the Pittsburgh Reduction Co., Pittsburgh, Pa.

In discussing the probabilities regarding the effect of smokeless powder on the tactical operations of the future, Capt. Benson says that infantry will gain by increased facilities for fire discipline and control, improved shooting, non-betrayal of the presence of skirmishers in broken ground, of sentries on outpost duty, and of firing lines of defense, while there will be greater exposure.

The present capacity of the plant at Pittsburgh, Pa., is limited to 550 pounds per day of 24 hours, but extensive additions will soon increase this quantity.

The process of its production is as interesting as peculiar, and is a perfect parallel to the electrolytic deposition of metals from an aqueous solution of their salts.

Capt. Benson finds many advantages in smokeless powder for the artillery and machine guns, remarking only that changes of position will be more open to view and that it will be difficult to detect individual skirmishers advancing over cramped ground and picking off gunners. Reconnaissance will become more difficult, and probably it will be necessary to add to the offensive power of cavalry.

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TO WHOM IT MAY CONCERN.

This is to certify that THE AMERICAN ENGINEER, of Chicago, Ill., is the only duly authorized official organ of The American Order of Steam Engineers.

JEFFERSON YOUNG, JR.
Supreme Chief Engineer A. O. of S. E.

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Contents of this Number.

SPONTANEOUS BLAZES.

In our last issue, mention was made of the burning of Siegel, Cooper & Co.'s mammoth store, in Chicago, when quite a million dollars' worth of property was destroyed. It was a great wonder and "the talk of the town" for two or three days, and then forgotten—except by some three thousand clerks, salespeople, teamsters, porters, janitors, and other wage-earners who temporarily are thrown out of employment by the destruction of their former place of work. "So great is the wealth, so numerous are the enterprises, so swift the motion of Chicago, that a disaster which would be date-making in the metropolis of an agricultural State is talked of for but a few hours, and then is forgotten as the manner of the death of Amenophis III.

"Twenty-five hundred people form quite a city in a farming country; most of the county seats in the forty-four States of the Union fall under this standard of population. Some of our great stores are filled, from morning till evening is far advanced, by a number exceeding the population of many a town that has its mayor, town council, and electric lights. This simple statement of fact throws the magnitude of Chicago's trade into strong relief, but it also emphasizes the necessity of protection against sudden fires."

The paper from which these quotations are made puts great stress on the necessity of making our great stores fire-proof—a very wise thing to do. But the reason for that necessity is much strained by the paper referred to. It says, "If such a fire had broken out, and consumed everything so rapidly as it did when the store was open, and with 2,000 or 3,000 customers and salespeople present (as was usually the case, especially on Mondays and Saturdays), hundreds of men and women would have been literally roasted to death, as they could never get away rapidly enough."

The fire broke out about 7 o'clock on Monday morning—just as some of the employees were beginning to arrive. No doubt it was the opening of the premises that started the fire—by letting in a flood of oxygen. If the cause of the conflagration was an overheated boiler, as is believed, the heat had penetrated the whole building, and its contents, more or less, and consumed the oxygen, for want of which the heat could not break out into a flame. But when the engineer (Seaferth) entered the building, smoke was immediately noticed over the boiler room; thereupon the foreman of one of the departments smashed a window in that quarter, and thereby unwittingly let in a flood of the very element which the intense heat was waiting for, so to speak, and then the whole building was ablaze as suddenly as a match is lighted. If they had kept out the fresh air, and diminished the great heat first, then that immense fire might have been avoided.

At all events that is how spontaneous combustion generally occurs, namely by letting in fresh air on intense heat. In fact, fire will not burn where oxidized air is excluded. And in the daytime, in a large store where thousands of people are present at one time, it is some consolation to think that a terrific blaze cannot sweep over the building all at once, as occurred on opening up Siegel, Cooper & Co.'s store on Monday morning. If a fire had broken out in the neighborhood of the boiler room when the store was open, in the middle of the day, the flames would have consumed that portion first, and extended as the surrounding portions became heated, from the original blaze, which of course would be rapidly enough. But the point we wish to emphasize is, that to enable a blaze to spread like lightning, so to speak, the heat from the boiler must have been kept up for many hours, and absorbed the oxygen from the heated air throughout the building, in a manner that could not possibly occur if the doors or windows had been open.

In this connection it may not be inopportune to remark that whenever an engineer finds, on reaching his place before a building is open, that the air is intensely heated, the slower he lets in fresh air (until the atmospheric heat is reduced) the safer will it be. And when a fire is discovered in a part of a big building (or in any building) it is the greatest folly to smash a window, and thus let in fresh air, as was done at Siegel, Cooper & Co.'s. Firemen often commit this great mistake. And we often read that, "when the windows were smashed, the flames broke forth like fiery tongues which licked up everything before them," or something to that effect. Every effort should rather be made to keep out the fresh air until the heat inside is reduced by means of water. And when a hole has to be broken to let in the hose, the smaller it is made the better.

HOW IS THIS, MC KINLEY?

The wages of wrought iron pipe and boiler tube makers are to be reduced, according to a despatch from Philadelphia, which says: At a meeting of manufacturers of wrought iron pipe and boiler tubes, the present deplorable condition of the trade and the low prices now obtained was discussed. It was the opinion of those present that unless better prices can be obtained for tubular goods, the ultimate result will be not only to shut down a large number of mills, but also a reduction in wages and of general expenses necessary to meet the present ruinous competition. The only conclusion reached at the meeting was an agreement upon a reduction of 2½ per cent. in the rate of discount to the trade, thus increasing the manufacturers' price to that extent. Another meeting will be held in New York on Sept. 10.

FATAL STEAM PIPE EXPLOSION.

A special telegram from St. Louis, Mo., of Aug. 10, says:

The steamer Crystal City this evening brought to this city several victims of an explosion that occurred on the steamer Idlewild last night near Genevieve, 100 miles down the river. About 9 o'clock last night while the engineers and firemen of the Idlewild were busy in the engine-room, one of the steam pipes suddenly burst. Sam Jackson, a colored fireman, and another negro, also a fireman, whose name is unknown, were both blown into the river. In their horribly scalded and stunned condition the two were helpless, and both drowned within a few rods of the steamer before any attempt could be made to rescue them.

Charles Anderson and Marshal Carter, deck hands on the Idlewild, aged respectively 28 and 29 years, were fearfully scalded by escaping steam, and both will die. Dan Biehle, a colored passenger, was also hurt. They were standing almost directly in front of the bursting steam-pipe, and received the full force of the escaping steam, almost their entire bodies being horribly burned. The two deck hands presented a frightful spectacle as they lay on the deck of the Crystal City this afternoon, and their suffering seemed to be almost beyond the power of human strength to bear.

THE WORLD'S FAIR POWER PLANT.

As we have mentioned in previous issues, a great power plant will be installed at the southern side of Machinery Annex. It is now stated that a plant capable of developing 24,000 h.p. will be required. Power to drive the machinery, in various parts of the Exposition, will be developed here, and transferred by means of electricity, to the various locations where it will be required. It will no doubt be the greatest steam and electric power plant ever installed in one place.

1,600 h.p. at least will be required to run the electricity for light and power on the grounds.

The power at the Philadelphia Centennial was furnished by the Corliss engine now at Pullman, with a capacity of 1,456 horse power. At the Paris Exposition 6,000 horse power was required.

In the machinery hall at the coming exposition the machines on exhibition will be driven by six lines of shafting carrying the required pulleys, each line running lengthwise with the building, or about 800 feet. Each of these six lines will be divided into four sections of a length of 200 feet, and each section will be driven by an engine, necessitating the use for power in machinery hall of twenty-four engines with a capacity of from 125 to 200 horse-power.

At the east end of machinery hall will be located the exhibit of pumping and hydraulic machines in operation, which will supply water for all of the grand fountains on the grounds and for other purposes. Here will be a pumping plant almost equal in capacity to the water works of Chicago. There will be pumps working with a capacity of 40,000,000 gallons per day.

To run these big plants during the exposition will require at least 75,000 tons of coal, or 225,000 barrels of crude petroleum, with 250 engineers, firemen and assistants to man this plant. To keep it bright and clean during the exposition will require 90,000 pounds of waste, and it is estimated that $9,000 worth of lubricating oil will be poured on its innumerable bearings.

"Bridge Design" was the subject of a paper read before the Engineers' Society of Western Pennsylvania, at a recent meeting, by Mr. Harry J. Lewis. It is printed in pamphlet form, and is well worth reading by all interested in building bridges. Mr. Theodore Cooper, of New York, was present, and remarked that we are to "bring to the practical application a large amount of common sense. A man may have all the knowledge as to how a joint should be made, how a bridge should be constructed, how to apply the mathematical solutions, how to make a drawing, and all that, yet he may grow grayheaded and not know how to design." In all things common sense is useful.

ELECTRICITY.

X.—THE GALVANIC BATTERY.

Chemical action is attended by the evolution of electricity. This subject was referred to under the caption of Dynamic or Voltaic Electricity (Chapter IV). Volta, however, was prevented (that is, led or preceded) by Aloisio Galvani, who stumbled across the discovery of this most important branch of electrical development quite accidentally, in the year 1790 (or 1786 according to some). And thus Galvanism or Voltaic electricity first became known only a little over one hundred years ago.

Galvani was a professor of anatomy at Bologna, Italy. His wife, being seriously unwell, was recommended to try frog broth. A number of dead frogs, ready for boiling, were in a dish on a table in Galvani's laboratory. His assistant was amusing himself with an electric machine. And Galvani noticed that, while the young man was turning the electric machine, and making the sparks fly, the dead frogs were jumping about in the dish!

This amazed Galvani. But he soon perceived that the limbs of the frogs were convulsed only when the sparks were emitted from the electric machine. He knew nothing whatever about the law of induction in electrical sciences. And a greater surprise was in store for him. He prepared a number of frogs, laying bare their lumbar nerves. And he put some copper hooks in them. He had no particular reason for choosing copper ones, only they happened to be handy. Then he hung them up to wait for further experiments. He hung the other ends of the copper hooks on an iron rod. And it seems to have been a thick bar of iron, for, as the copper hooks were placed thereon, the legs of the frogs touched it—that is the iron rod, and behold! they were electrified. To be exact, it was the muscles of the legs that touched the iron; and when Galvani noticed that the copper hooks touched the nerves, he theorized that there was a natural flow of electricity from the nerves to the muscles, and that, when the circuit was completed, contraction of the limbs followed. This theory was popularly believed in for a time. The fact that two kinds of metals were required was not noticed until later. Galvani could not imagine the real cause of that electrical phenomena. He supposed the electricity must be in the frog. And he had an idea that there was electricity in the air. And one clear evening, in the early part of September, he brought out his frogs, with a hook in the spine of each, and hung them on his iron railing. Surely enough the electric twitchings were there. The electric machine was far enough away; and Galvani concluded that the electricity was in the frogs.

Volta, who was a professor of natural philosophy at Pavia, Italy, and about eight years younger than Galvani, took up the frog experiments. He observed that a rod of iron only, in contact with frog's muscles, would produce no convulsions; while a rod made partly of iron and partly of copper produced the effect which Galvani had discovered, if both ends touched the muscles. He therefore came to the conclusion that electricity was produced by the contact of two dissimilar metals, the frog's muscles and nerves being only conductors for the current.

Many electricians now doubt Volta's theory, that it is the contact of the two metals which develops electricity. Certain it is, however, that in connection with a third element, a certain kind of moisture being the best, the electric current is generated by two different metals—copper and zinc being the most effective. And if a round piece of zinc, about the size of a quarter, be placed on the upper side of the point or side of the tongue, and a similar piece of copper, or a silver quarter, underneath the tongue, and placed so that the edges of the metals are in contact with each other, an electric current will be generated. It produces a peculiar taste. And it is common enough for working electricians to place the terminal wires of small batteries to their tongues to see if they are working all right.

And right here it may be well to remark that if any reader of these articles has a garden, or flower bed, which he wishes to keep free from slugs and snails, all he has to do is to edge it around with a strip of copper having a strip of zinc soldered on to it. As soon as the snail comes in contact with this double strip, it has a taste of electricity sufficient to cause it to draw in its horns and depart. If it touches the copper-zinc strip a second time, that will be enough—it will never come against it any more. Snails and slugs are thus effectively keep out of the enclosure.

Wires of copper and zinc twisted alternately round the bottom of poles which support dahlias have a similar effect.

But, to come to the Galvanic battery. When electricity is produced through the contact of two different metals, such as copper and zinc, combined with some acid solution acting on one of them, chemical electricity is produced, and a galvanic battery is the name of the combination. A simple galvanic circle, consisting of one cell, is shown in Fig. 9. The letters C and Z represent respectively copper and zinc plates, placed in dilute acid and connected by a wire. Electric action takes place on the surface of the zinc, covered by the liquid. Positive electricity is generated at the zinc plate, and flows through the liquid to the copper, from the copper through the wires to the zinc. Thus a constant current is established over the wires in the direction indicated by the arrows. The terminal end of the wire leading from the zinc plate is called the negative pole or electrode, and the one leading from the copper is called the positive electrode. To make this point positively clear, let us repeat it, in other words, and say that the positive electrode (or wire) is attached to the negative plate; and the negative electrode is attached to the positive (zinc) plate, or else the current would not circulate. As it is, it is generated on the zinc plate (positive), thence to the wire attached to the copper plate, which is positive, and from that to the wire that is attached to the zinc plate, which is negative; and from the latter wire, or electrode, the current passes on to the zinc or positive plate. And thus it keeps going the round.

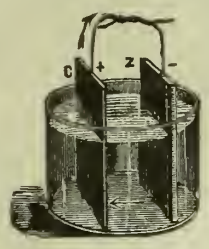


Fig. 9.

When the wires are separated, the circle is broken, and the current ceases to flow.

The compound galvanic circle (or galvanic battery) is composed of two or more simple cells or circles. They are so connected that the copper (C)

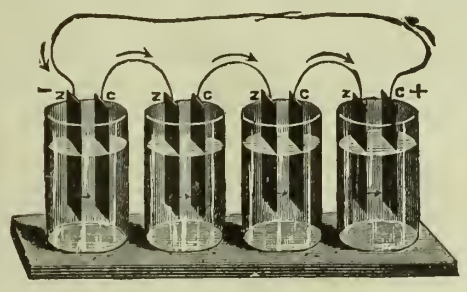


Fig. 10.

of one cup is joined to the (Z) zinc of the next, and so on through the whole series, as shown in Fig. 10. The arrows indicate the direction of the current.

In the compound circle it will be seen that the current starts at the zinc plate, on the right, to the copper plate in the same cell (as in simple circuit), then to the zinc plate in the next cell, and so on until the current reaches the copper plate in the last cell, whence it returns, by wire, to the first zinc plate. The negative electrode, or pole, being on the left side (attached to the positive or zinc plate), and the positive pole on the right.

The cells in Fig. 10 are coupled "in series." There are various other ways of connecting them. They may be placed in two rows (instead of one), with the zincs of each row joined together at one end, producing the negative pole, and the copper plates united at the other end producing the positive pole. A zinc plate is joined to a copper one throughout this circuit (like in that shown in Fig. 10) except at the ends. Another way is to place them in three rows, where the three zinc plates at one end (or on one side) are joined together to produce the negative pole, and the three copper plates are united on the other side. Another plan is to place the cells in a row, but instead of having the copper plate of one cell on the side nearest the zinc plate of the next, the zincs are all on the nearest sides of the jars, and the coppers on the furthest, as if the cells in Fig. 10 were turned so that the copper stood behind (instead of parallel with) the zinc plate in each cell. Then all the copper plates are joined together, to form the positive pole, while the negative is derived from the joining together of all the zinc plates. That style of joining the cells is called "multiple arc."

A cell, or one of these vessels including the zinc and copper plates with the liquid, is also called an "element." When a number of cells are joined together the whole is called a "battery." The single cell is also called a battery when used alone.

A battery is also made of a trough, in which the plates are connected as in Fig. 10. It is not necessary that each couple should be in a separate vessel. But they must be immersed in acid or oxidizing liquid.

Before devising the "voltaic pile," mentioned in Chapter IV, Volta made his "couronne de tasses," which consisted of a circle of cups or glasses, each containing a zinc and a copper plate, connected as those are in Fig. 10, said plates being immersed in salted water. He also used water acidulated with sulphuric acid. And by thus bringing the crude discoveries of Galvani into a practical system, Volta laid the foundation of that very important branch of electrical science, called dynamic or moving electricity.

All electric batteries are made on the voltaic principle. The differences between modern makers are only differences of detail. Daniell's battery consists of zinc and copper plates, but the zinc is immersed in dilute sulphuric acid, or a solution of sulphate of zinc, while the copper is placed in a saturated solution of sulphate of copper. The common "gravity battery" is similar, and is so named because of the automatic action of the two fluids which are separated by their specific gravities. In Grove's battery, platinum is used (instead of copper) with the zinc; and two fluids are used, one in a porous cup placed in the middle of the other liquid. The two liquids increase the power of the batteries. Bunsen's battery differs from Grove's in having carbon of gas coke in place of platinum, and it is on that account also called the Carbon battery. Leclanche's battery consists of zinc in a solution of ammonia chloride, and gas carbon surrounded with manganese dioxide in a porous cell.

We will dilate upon these elements further on. Let this brief mention suffice here. But we may just add that, in practical operation, these batteries are used for two kinds of work, designated "open circuit," and "closed circuit." The open circuit is that where the electric current is only used by "fits and starts," such as for ringing house bells, telephone signals, or hotel annunciators. Closed circuits are those in which the current is in constant use, such as for electric lamps or when furnishing power.

Then there are primary and secondary batteries. The primary ones are those which generate electricity, in the first instance. Secondary or storage batteries furnish the electric current second hand, as it were, that is, electricity is "stored" in them, from a primary battery (in which the electricity is generated by chemical action), or from a dynamo, and used when required.

The chemical action is different in the primary and storage batteries. The action in the first, if it consists of zinc and copper with merely water, is this: the zinc decomposes the water and draws away the oxygen, with which it forms an oxide of zinc. The hydrogen, when let loose, decomposes the particle of water next to it, and again unites with the oxygen to re-form water. The change proceeds, like the waves on the surface of a lake, until the copper plate is reached, and then the hydrogen gives up the contest, so to speak, and rises as a distinct gas.

Diluted sulphurid acid, that is, water with sulphuric acid in it, is a better conductor than simple water, and it rapidly removes the oxide which forms on the surface of the zinc, thus keeping the zinc surface clear, so that it is being oxidized (by combination with the liberated oxygen), and then

directly cleaned by sulphuric acid, continually. Most of the leading electricians maintain that the electricity is produced by the decomposition of the water, and not by the solution of the oxide of zinc.

A storage (or secondary) battery consists of a number of lead plates (never less than two) placed in a vessel made of some nonconducting material, such as glass, containing acidulated water. One plate is connected by wire with the positive pole of the electric generator (a dynamo or a primary battery) and becomes the positive electrode of the circuit (the conductor, between them, being negative). The other plate (when there are only two) is connected with the negative pole of the generator. While the process of "charging" is going on, the current goes in by one plate (or electrode) and out by the other.

The positive plate (in the secondary battery) is covered with red-lead paste, and the negative plate coated with litharge paste, before being put in the acidulated water. When the current is turned on, it works upon the coating of both plates, and the red-lead paste on the positive electrode is changed to peroxide, that is the highest oxide of lead, and the litharge paste on the negative electrode is changed into spongy lead.

After the current has been working the secondary battery in that way, for a time, the conductors or wires between it and the generator are disconnected. When a current is wanted from the storage battery, or accumulator, as it is sometimes called (on account of electricity having accumulated therein) the plates are connected with the point where the current is wanted, and a circuit of current is formed. While this circuit is in operation, the paste on each plate gradually returns to its original condition. And the return of the one to red-lead and the other to litharge paste is complete, the battery is said to be discharged, and is then ready to be re-charged.

In these accumulators, the discharge is gradual. And large storage batteries on street cars will take several hours to "run out." As previously stated, the Leyden jar will accumulate electricity, but its discharge occurs all at once.

SMOKE NON-CONSUMERS.

This is really the most correct name. In a recent number we referred to a "perfect" smoke consumer at the Leland hotel, Chicago, which did not consume the smoke, when we called to see it.

Now comes some lively correspondence referring to this subject, which we take from the Chicago *Tribune*, as follows:—

In an article in your Sunday issue headed "The Richelieu Hotel Company Institutes Actions for Damages" you say, "Herman Dalke claims the Richelieu Hotel chimney is one of the worst nuisances in the city; that it is continually emitting dense clouds of smoke."

I am not acquainted with Mr. Dalke, and never heard of him before. If he has made any such remark he has certainly stated what is not true, as ever since I have been using my "smoke-consuming device" there has been practically no smoke to be seen issuing from the chimney, and Mr. George, the smoke inspector, at my request has examined the matter and pronounced the device the best he has seen. Mr. Dalke has undoubtedly mistaken my chimney for one that is near mine belonging to another party.

There is a space of fifteen feet between the Richelieu Hotel and the Leland; the chimney of the Leland is built against the wall of the Richelieu and has the appearance of being the Richelieu chimney, but it is not. I think Mr. Dalke will admit that he was mistaken, and do not at present believe he intended to misrepresent the facts or do me an injury.

The following letter handed me by Capt. Tarr (of Henry Worthington & Co., New York), a gentleman known in every State of the Union as an expert in such matters, speaks for itself.

"Chicago, Aug. 3.—H. V. Bemis, Esq., Chicago, Ill.—Dear Sir: I have observed with great interest your smoke-consuming device. I have never seen so perfect a fire on a grate with this quantity and quality of coal.

The brief tests we have made show the consumption of smoke to be almost perfect. On my return to Chicago, if practicable, I shall take great pleasure in making a test showing the relative evaporation of your boilers with and without the device, as from appearance there must be a material saving. Truly yours, H. G. H. Tarr.

W. H. Adams of No. 71 Wall street, New York, the well-known chemical engineer and expert, who is at present in the city on professional business, has examined my devices several times during the last ten days and says: "I approve and coincide with all that Capt. Tarr has said in the above letter and will at once put the device into a large soft-coal burning plant in the East, when I will thoroughly test the same in a technical manner to substantiate the practical results already obtained here."

I invite all parties interested in doing away with the smoke nuisance to call at the Hotel Richelieu and examine my device, and I promise to show that inferior soft coal can be burned without injury to the boilers, grates, or devices and that the devices I use are the most simple and durable and will give better results than any that have been used before. Very respectfully,

H. V. Bemis, President.

CHAT WITH A CHIEF ENGINEER.

"I see there is another case of boiler blister in one of the new whale-shaped barges," said the chief engineer, "and it would be interesting to know who pays for the blister. The engineer says 'soft steel' in the furnace did it and the boiler builder says it was the engineer's negligence that did it. What the owner thinks will cause the biggest argument. The first thing to consider is whether or no the boiler builder would put 'soft steel into a boiler. Sec. 4430 of the steamboat inspection rules would bear down pretty hard on this 'soft steel,' but a decision from the treasury department a number of years ago only requires inspection of shell plates. (In parenthesis I would remark that the United States government pays out at least $100,000 each year for marine boiler inspection, and pays not one cent for stationary boiler inspection, from which one might infer that marine engineers' lives are worth preserving.) But if the 'soft steel' didn't blister the boiler then the engineer did. I suppose you think the engineer went to work and made a mustard plaster and put it on the tenderest spot. No, it is easier than that. Why a mustard plaster wouldn't make a boiler stop 'priming,' not to mention warping it out of shape. The chances are that he forgot to play with the surface blower each watch. How would that have prevented the blistering? This way! When the oil or grease came in with the feed water it swam around on the top until it gathered enough sediment to sink it. And by the way do you know that there is calm weather, nor'westers and regular cylones in your boiler. Sometimes the water is level and quiet and steaming like a mill pond on a spring morning, and sometimes again the water at the bottom thinks it isn't having a fair show at steaming and then the top and bottom water have a stormy time for an hour or two. But this grease gets tired swimming around, and if it isn't skimmed off by the surface blower down it goes on the furnace. Then where that lies heat can not get through to the water and it stays in the iron until it is red-hot and blisters. If there is any animal grease in the oil the blister comes very quick. You may think this is funny, but take a tin can and after smearing linseed oil on the bottom inside, fill it full of water, put it over a lighted gas jet and see if the tin don't get red-hot before the water boils.

"This blister on the whale-shaped boat's boilers isn't the only case. Why, one of our bran new steel steamers got a touch of it this spring. The engineer said he filled one of the boilers near the gas-house in Chicago river, and as that was the only one burned, it is reasonable to presume that gassy or greasy water caused it. I have in mind a case that happened several years ago on a boat belonging to a large Cleveland fleet. The engineer ran out of oil and bought some at Duluth. It was learned afterwards that the oil was put in a linseed oil can that contained some of the original linseed. Chemists found traces of the linseed oil on the scale, but the engineer said that it was 'soft steel' and the owner believed the engineer, which they sometimes fail to do, I am sorry to say. It came near resulting in a law suit. In fact I don't remember how it did end, but think that the boiler builders convinced the owner. These cases aren't a 'patch on' one or two others I know about. One was on the yacht Peerless. She came from the coast with a surface condenser and the first triple expansion engine that was built in this country. Although the latter was disputed, the former isn't, because as soon as she got away from salt water there was nothing to cut the oil and as all the condensed water goes back to the boiler, all the oil that got into the cylinders went to the boiler and raised —— blisters. The Canadian Pacific steamer Campana had the same experience, but let one of our jet condenser steamers go to salt water and I guess there would be some blistering, from a different cause though. The salt left by evaporation would settle down on the crown sheet, and not being used to the salt it would naturally get warm, red-hot in fact. A young friend of mine went 'first' in the Ranney a number of years ago, and deciding to get rid of the scale, which had accumulated under the regime of his predecessor, he put a whole barrel full of black oil into the boiler. The result was that the Ranney's furnaces 'came down' in corrugations that would make a Continental furnace jealous. My owner came into the engine room the other day and among other things he asked was for me to trace the water from the seacock to the condenser discharge, and next time I'll tell you how I did it."—E. N. Gineer, in the *Marine Review*.

QUERIES AND ANSWERS.

Queries.

The Educational Correspondent of Kensington Council, Philadelphia, wants to know—

1.—Where to get a work or periodical articles on the proper construction of gas burners? He is "engaged on a subject which appertains to gas fixtures."

2.—Where he can get the best directory of "metal working manufacturers?" He wants to find a "building hardware" firm who will promote a patented article.

Answers.

1.—The E. P. Gleason Mfg. Co., 181 Mercer St. New York City, is a good house for gas fixtures.—L. Schutte & Co., 12th and Thompson Sts., Philadelphia, sell gas burners.—*Progressive Age* (18 Broadway, New York) is a journal devoted to gas, electricity and water; and they sell "The American Gas Engineer and Superintendent's hand book," price $3.—Then *Light, Heat and Power* (Drexel Building, Philadelphia) claims to be the Independent Gas Journal of America."

2.—The *Metal and Iron Journal*, cor. Lake and Clark Sts., Chicago, may be able to direct the enquirer to a builders' hardware house that would promote a patented article. But full particulars should be stated as to what the article is, etc.

HORSE-POWER OF WHALES.

Sir William Turner, the present eminent Professor of Anatomy in the University of Edinburg, Scotland, has given much attention to the study of whales, their structure, habits, etc. He estimates that the great Greenland whale (average length fifty feet) attains a maximum speed while swimming of ten miles an hour; the "Finner" whale (maximum length eighty-five feet) often making twelve to fourteen miles an hour. Mr. Turner in one of his lectures said that he and John Henderson, of Glasgow, the well-known builder of the Anchor line steamships, had spent much time in trying to arrive at a satisfactory conclusion as to the horse-power exerted by large species of the whale in making a speed of twelve miles per hour. As a base for their conclusions they took the size and dimensions of the great "Finner," which was stranded on the shore at Longuiddry some years ago. It was 80 feet long, weighed 74 tons, and had a tail which was 20 feet across at the extreme end of its flanges. With these data, Messrs. Turner and Henderson calculated that a whale of the dimensions mentioned, in order to attain a speed of twelve miles an hour, must exercise a propelling force of 145 horse-power!—*St. Louis Republic.*

Daughters of Fulton.

A new auxiliary for Philadelphia was organized at Brandywine Springs, during the A. O. S. E. picnic, Aug. 1, with Mrs. German Smith as past matron, Mrs. Minerva J. Hartzman as matron, Mrs. Emily Evans as treasurer, and Mrs. John J. McManaman as Secretary. All members and honorary members of this new auxiliary are connected with Kensington Council except two.

In Memoriam.

To the Editor of the American Engineer:

Sir:—We the members of John E. Sweet Council, No. 6, N. Y., are called upon to perform the painful duty of recording the death of Brother Harry Haylor's wife, age 31; died July 29, 1891; interred at Wood Lawn, Aug. 2, 1891. The engineers and Daughters of Fulton attended in a body.

The Council, at its regular meeting, adopted these resolutions:

Whereas, It has pleased the Supreme Ruler of the Universe to remove from our midst the wife of Brother Harry Haylor to that undiscovered country from whose bourn no traveler returns,

Therefore, Be it thus resolved that the American Order of Steam Engineers has lost a good assistant and a willing hand to administer to their wants during sickness and distress, and be it

Resolved, That we, the John E. Sweet Council of the said Order, extend our sympathy to the bereaved husband and orphans during this their hour of sorrow; and be it also

Resolved, That a copy of this be sent to The American Engineer for publication, and a copy spread on our minutes, and also sent to the bereaved family.

W. A. Gleave,
James H. Benedict,
Benjamin Ruston. } Committee.

CORRESPONDENCE.

Old Slide Valve and Corliss Engines.

To the Editor of the American Engineer:

Sir:—I have been very much interested in the articles published in your valuable paper; and I think a good deal can be learned by facts presented: and I often think when looking back, what early inventors had to contend with—everything to discourage them, and being looked upon as being insane, and their friends found fault with for not putting them in insane asylums, etc.

In reading an account of Fulton during the progress of the building of his famous steamboat, that on going to and from the ship yard he would often come across groups of men talking together, and he, unknown to them, would stop and listen to their conversation, which often was about the crazy idea of Fulton applying steam to a boat; every one predicted failure, and he afterwards said that if he had only heard a wish that he might succeed it would have given him great encouragement, etc.

So in our advanced age of improvement comes the improvements of the engine, and some facts come out relative to the articles headed Old Slide Valve vs. Corliss. A great many facts on both sides have been presented, and they commence to figure to prove their argument.

All this I am glad to see, but I would like to see others tell what they know on the subject; a great many must have had more or less experience with engines of this class.

In reading the last article a case has been called to my mind in this city. There are two plants side by side, in fact their boiler rooms are together, one a confectionery and the other a coffee and spice factory. When fitting up their plants, each thought the other knew nothing about it, but that they did; and often arguments with each other would occur between them. They both had about the same boiler power; the coffee factory had a 60″x20′, with 48-4″ tubes boiler; the confectioner's boilers were two 44″x20′, with 24-4″ tubes. The first had a Corliss 14″x36″, making 90 rev. a minute; the other a 12″ x24″, 100 rev. Both commenced running about the same time; the old slide valve has kept right on doing her work, not having to shut down for any thing, and doing more work than the Corliss. The first has more machinery, and 3 elevators, while the Corliss has only 2 elevators and less machinery, and not a large factory by one-third as the other. During the cold weather, when they heat their factory by steam, they burned as much coal as the candy factory did, who used a gread deal of steam for cooking, and now just running their engine they burn daily 50 bushels of coal, the others running their engine and cooking only burn 85 bushels of coal; this is daily results, without trying to see how economically they could run.

And another point I want to mention is that two or three times the Corliss valve gear let down when 6 large coffee roasters were full, and the coffee burned before it could be adjusted so as to start up again.

Now I think, taking these facts, and summing them up, they will show that the old slide valve is far ahead. Since starting up, the Corliss broke the valve cap and bent the valve stem, causing a delay of 10 days for repairs, in their busiest time; but not 1 cent of repair on the old slide valve. At first the party made fun of the old slide valve, but the laugh has come on the other side, and they call her "The old reliable."

I think the coffee burned will cost more than coal saved in a year by the Corliss engine, not counting the loss by shutting down the factory for repairs.

I will write you again on some other experience with other engines, etc. Fraternally yours,

Old Reliable.

St. Louis, Mo.

SOUTHWARK VS. KENSINGTON BALL GAME.

The American Order of Steam Engineers in Pennsylvania, were out in great numbers at Brandywine Springs, August 1.

The grand council of the State of Pennsylvania gave an excursion to that famous spot of earth on that day. Mr. and Mrs. Jefferson Young were there. So was Mrs. Minerva Hartzman, the matron of the new Daughters of Fulton auxiliary at Philadelphia, as well as her husband, Mr. L. W. Hartzman, past chief of Kensington Council, No. 3, and who is superintendent of construction of the pneumatic railway that is going to be the rage. There were others whose names ought to be mentioned, if our correspondent had sent them.

At Brandywine Springs, on August 1, the ground was muddy and the rain was falling, but yet the excursionists had a good time. Bro. Harry Hohn was there with his two lady cousins.

It is said that not a member of either Southwark or Kensington Council knew how to throw a ball, let alone catch one! Chief Young took off his coat and turned up his pants' legs, and showed them how.

ANOTHER VERSION.

As I promised, sometime since, to send you a report of the excursion of the Pennsylvania A. O. S. E. councils to Brandywine Springs, I now fulfill my promise.

This excursion was not a great success. The weather was dead against us. We enjoyed ourselves first-rate, however; even the mud afforded us much fun. We danced, and played base ball, and had sack racing and other sports.

The "feature" of the excursion was the base ball game between Southwark Council No. 4, and Kensington No. 3. It began to rain very hard as soon as the game commenced. Only two innings were played. Bro. Frank Widener was chosen umpire, and our Worthy Supreme Chief Engineer Jefferson Young, Jr., was chosen as score-keeper. I am very sorry I can not give you all the names of the players. Southwark was first at the bat. After a great struggle they made two runs when their third man was put out. Kensington sent one of her bald heads to the bat, who soon was put out on strikes; he declared the bat had a hole in it. After a great deal of kicking about the rules, which nobody seemed to understand, they made two runs, tying the score, when Kensington's third man fell a victim. Then all was enthusiasm, and Southwark again went to bat. But it did not last long, for the rain began to come down very hard. The grass being very thick and wet, it was a great difficulty to drive the ball any distance, so after playing as best we could in the rain, all the bases full and none out, someone drove the ball out to left field, all four men scored, and then they got another man across the plate, before their last man was put out; the score now standing 7 to 2. Nothing daunted, Kensington again went to bat, but as none could hit the ball they were soon put out. It rained too hard to continue the game, and we all wended our way to the dancing pavilion, where we found Bro. Frank Mellor and someone of Southwark getting ready for a sack race, in the middle of which down went Southwark, and over and over he rolled. After getting on his feet again, he made a desperate spurt and beat Mellor amidst great cheering. The next race between Mellor and Lightfoot, Lightfoot winning. Next Lightfoot and Hardy of Kensington, Hardy winning by hopping the whole distance. Lightfoot claimed it unfair, but the objection was over-ruled.

Dancing was next in order. To do justice to this report we are short the services of Dr. Blue Blaser; he is the only one that could make this part interesting to your numerous readers. Suffice to say I missed my partner from Massachusetts, Bro. Boen. I tried hard to get a very stout lady (about 350 in weight) to dance, but she thought two such heavy weights might stand a good chance of going through the floor.

Next was a merry-go-round, which the boys seemed never to tire of until train time. But how it rained. And when we arrived in Philadelphia it fairly poured down.

We had the pleasure of the company of our Worthy Supreme Chief and his smiling wife who, by the way, is getting up a Daughters' of Fulton Auxiliary in Philadelphia.

Bro. Harry Hohn was also there.

One of Them.

DAVID GILBERT COUNCIL PICNIC.

"This is the largest excursion but one that has visited these grounds," said the proprietor of the celebrated picnic grounds at Arlington, Neb., on Sunday, Aug. 2, when the David Gilbert Council, No. 2, Neb., were there.

This excursion was a very pleasant affair, and enjoyed by all who participated. At nine o'clock Sunday morning, a train of seven coaches, crowded with engineers and their friends, left Webster street depot, Omaha, and was transported to Arlington without a hitch. And no accident of any kind happened to mar the pleasure of the day.

As soon as the picnic grounds were reached, everybody went in for a good time, and they had it. It was an occasion that the David Gilbert Council may well be satisfied with. The net proceeds, after defraying all expenses, were in the neighborhood of $200.

The membership of the Council is increasing, having initiated two the last meeting. Brother Cooper, our Deputy Supreme Chief Engineer, wears his honors with becoming grace. He is a man who takes a deep interest in the success of the Order, and will leave no stone unturned towards its advancement.

All of our newly elected officers take to their positions as though of the manner born, and there is no reason that David Gilbert Council of Nebraska will not be the banner Council of the State.

J. L. Miller, C. E.

A QUEER WAY TO DRINK WINE.

The mountaineers drink in a curious fashion. Throwing back their heads, they raise the wineskin in the air with both hands, and allow the thin stream which flows from the pin-hole in the horn nozzle to fall into their open mouths from a distance of several inches. With a bottle they manage to do the same by narrowing the mouth with the thumb and forefinger. The motive of this procedure is economy. In these regions of high air, intense fatigue, and snow-water, wine is at once the most refreshing and the heaviest thing among the provisions. And, they assert, that drunk in this manner, one litre goes as far in the way of refreshment, as three drunk in mouthfuls from a cup. It is true; but the first efforts of the duffer are apt to end in landing the red stream in his eye or on his chin—which impairs the economy of the proceeding. From "Izard Hunting in the Spanish Pyrenees," by Paul Van Dyke, in July *Scribner*.

WEIGHT OF GALLON OF SPRING WATER (FILTERED).

By JERRY LEAHEY, Jr., Perth Amboy, N. Y.

Temp. Fah.	United States.	New York.	Imperial.	Temp. Fah.	United States.	New York.	Imperial.
32	8.3617149	8.0286547	10.0343949	123	8.2607679	7.9277077	9.9344488
33	8.3619609	8.0289007	10.0356418	124	8.2599925	7.9269323	9.9336734
34	8.3622231	8.0291629	10.0359040	125	8.2576956	7.9246354	9.9313765
35	8.3623848	8.0293246	10.0360657	126	8.2554318	7 9223716	9.9291127
36	8.3625003	8.0294401	10.0361812	127	8.2532835	7.9202233	9.9269644
37	8.3626389	8.0295787	10.0363198	128	8.2506270	7.9175668	9.9243079
38	8.3627313	8.0296711	10.0364112	129	8.2480860	7.9150258	9.9217669
39.3	8.3627775	8.0297173	10.0364584	130	8.2466076	7.9135474	9.9202885
40	8.3627544	8.0296942	10.0364353	131	8.2444593	7.9113991	9.9181402
41	8.3627082	8.0296480	10.0363891	132	8.2423341	7.9092739	9.9160150
42	8.3626158	8.0295556	10.0362967	133	8.2400472	7.9069870	9.9137271
43	8.3624772	8.0294170	10.0361581	134	8.2378220	7.9047618	9.9115029
44	8.3623155	8.0292553	10.0359964	135	8.2356351	7.9025749	9.9093160
45	8.3621076	8.0290474	10.0357885	136	8.2333713	7.9003111	9.9070522
46	8.3619459	8.0288857	10.0356268	137	8.2311075	7.8980473	9.9047884
47	8.3618304	8.0287702	10.0355113	138	8.2288206	7.8957604	9.9025015
48	8.3612991	8.0282389	10.0349800	139	8.2264182	7.8933580	9.9000991
49	8.3610450	8.0279848	10.0347259	140	8.2250158	7.8919556	9.8986967
50	8.3606294	8.0275692	10.0343103	141	8.2215903	7.8885301	9.8952712
51	8.3602043	8.0271441	10.0338852	142	8.2192110	7.8861508	9.8928919
52	8.3598438	8.0267836	10.0335247	143	8.2168086	7.8855484	9.8922895
53	8.3593125	8.0262523	10.0329934	144	8.2143831	7.8813229	9.8880640
54	8.3587581	8.0256979	10.0324390	145	8.2119807	7.8789205	9.8856616
55	8.3582499	8.0251897	10.0319308	146	8.2105783	7.8775181	9.8842592
56	8.3576955	8.0246353	10.0313764	147	8.2070373	7.8739771	9.8807182
57	8.3570256	8.0239654	10.0306865	148	8.2046347	7.8715748	9.8783156
58	8.3564943	8.0234341	10.0301752	149	8.2020939	7.8690337	9.8757748
59	8.3558244	8.0227642	10.0295053	150	8.1995529	7.8664927	9.8732338
60	8.3550159	8.0219557	10.0286968	151	8.1971119	7.8640517	9.8707928
61	8.3542536	8.0211934	10.0279345	152	8.1944709	7.8614107	9.8681518
62	8.3535606	8.0205004	10.0274211	153	8.1918144	7.8587842	9.8654953
63	8.3528214	8.0197612	10.0265023	154	8.1892503	7.8561901	9.8629312
64	8.3518050	8.0187448	10.0254859	155	8.1879318	7.8548716	9.8616127
65	8.3510196	8.0179594	10.0247005	156	8.1839142	7.8508540	9.8575951
66	8.3500625	8.0170023	10.0237434	157	8.1812346	7.8481744	9.8549153
67	8.3491485	8.0160883	10.0228294	158	8.1786936	7.8456334	9.8523745
68	8.3481214	8.0150612	10.0218016	159	8.1760140	7.8429538	9.8496949
69	8.3463005	8.0132403	10.0199814	160	8.1732189	7.8401587	9.8468998
70	8.3462971	8.0132369	10.0199770	161	8.1705393	7.8374791	9.8442204
71	8.3452677	8.0122075	10.0189486	162	8.1691995	7.8361393	9.8428804
72	8.3442051	8.0111449	10.0178860	163	8.1650646	7.8320044	9.8387455
73	8.3431194	8.0100592	10.0168003	164	8.1623850	7.8293248	9.8360659
74	8.3429568	8.0098965	10.0166377	165	8.1595899	7.8265297	9.8332708
75	8.3409942	8.0079340	10.0146751	166	8.1567717	7.8237115	9.8304526
76	8.3399085	8.0068483	10.0135894	167	8.1539766	7.8209164	9.8276575
77	8.3387073	8.0056471	10.0123882	168	8.1512970	7.8182318	9.8249779
78	8.3375061	8.0044459	10.0111870	169	8.1484788	7.8154186	9.8221597
79	8.3364436	8.0033834	10.0101245	170	8.1455451	7.8124849	9.8192260
80	8.3351037	8.0020435	10.0087846	171	8.1427500	7.8096898	9.8164309
81	8.3339025	8.0008403	10.0075834	172	8.1399318	7.8068716	9.8136127
82	8.3327013	7.9996411	10.0063822	173	8.1371136	7.8040534	9.8107945
83	8.3313618	7.9983016	10.0050427	174	8.1331173	7.8000571	9.8067982
84	8.3300217	7.9969615	10.0037026	175	8.1315003	7.7984401	9.8051812
85	8.3286819	7.9956217	10.0023628	176	8.1285666	7.7955064	9.8022475
86	8.3273421	7.9942819	10.0010230	177	8.1257715	7.7927113	9.7994524
87	8.3260254	7.9929652	9.9997063	178	8.1227547	7.7896945	8.7964356
88	8.3246856	7.9916254	9.9983665	179	8.1200196	7.7870594	9.7937005
89	8.3233458	7.9902856	9.9970267	180	8.1170628	7.7840026	9.7907437
90	8.3232070	7.9901468	9.9968879	181	8.1141291	7.7810689	9.7878100
91	8.3203890	7.9873288	9.9940699	182	8.1113340	7.7782738	9.7850142
92	8.3187951	7.9857349	9.9924760	183	8.1076073	7.7745471	9.7812882
93	8.3173167	7.9842565	9.9909976	184	8.1053049	7.7722447	9.7789858
94	8.3157495	7.9826893	9.9894304	185	8.1023712	7.7693110	9.7760521
95	8.3142444	7.9811842	9.9879253	186	8.0992989	7.7662387	9.7729798
96	8.3126505	7.9795896	9.9863314	187	8.0963421	7.7632819	9.7700230
97	8.3109180	7.9778578	9.9845989	188	8.0934084	7.7603482	9.7670893
98	8.3093010	7.9762408	9.9829819	189	8.0903361	7.7572759	9.7640170
99	8.3085685	7.9755083	9.9822494	190	8.0875179	7.7544577	9.7615988
100	8.3058360	7.9754758	9.9822169	191	8.0844456	7.7513854	9.7581265
101	8.3042190	7.9711588	6.9778999	192	8.0815119	7.7484517	9.7551928
102	8.3024865	7.9694263	9.9761674	193	8.0784396	7.7453794	9.7521205
103	8.3002227	7.9671625	9.9739036	194	8.0753673	7.7423071	9.7490482
104	8.2990225	7.9659623	9.9727234	195	8.0722950	7.7392348	9.7459759
105	8.2971504	7.9640902	9.9708313	196	8.0692227	7.7361625	9.7429036
106	8.2953948	7.9623346	9.9690757	197	8.0661504	7.7330902	9.7398313
107	8.2936623	7.9606021	9.9673432	198	8.0630550	7.7299948	9.7367359
108	8.2917912	7.9587310	9.9654721	199	8.0599827	7.7269225	9.7336636
109	8.2899201	7.9568599	9.9636010	200	8.0567718	7.7237116	9.7304527
110	8.2880490	7.9549888	9.9617299	201	8.0535840	7.7205238	9.7272649
111	8.2861779	7.9531177	9.9598585	202	8.0504886	7.7174284	9.7241695
112	8.2845088	7.9514486	9.9581897	203	8.0471622	7.7141020	9.7208431
113	8.2825357	7.9494755	9.9562166	204	8.0440899	7.7110291	9.7177708
114	8.2805646	7.9475044	9.9532455	205	8.0407404	7.7076802	9.7144213
115	8.2785549	7.9454947	9.9522358	206	8.0375292	7.7044690	9.7112101
116	8.2766607	7.9436005	9.9503409	207	8.0341800	7.7011198	9.7078609
117	8.2746510	6.9415908	9.9483319	208	8.0309922	7.6979320	9.7046731
118	8.2726857	7.9396255	9.9463666	209	8.0276424	7.6945822	9.7013233
119	8.2705392	7.9374790	9.9442201	210	8.0244318	7.6913716	9.6981127
120	8.2685295	7.9354693	9.9422104	211	8.0210823	7.6880221	9.6947632
121	8.2663812	7.9333210	9.9400621	212	8.0177559	7.6846957	9.6914368
122	8.2648335	7.9317733	9.9385144				

QUICKNESS OF STEAM PRESSURE.

Surprise is often expressed among engineers that steam in a locomotive at high speed can keep up with the piston, or rather that it can exert any pressure upon it. The velocity of the piston at high speeds is rising 1,200 feet per minute, but this speed is within the velocity of steam per foot per second, which is stated by various writers to be from 600 feet per second upward. We do not know that an reliable data exists as to the speed of steam per second.— *The Engineer*, N. Y. City.

"THE REVIEW OF REVIEWS."

This is the title of a monthly illnstrated paper, published in New York and London simultaneously. The August number of this "busy man's magazine" contains a heap of information concerning the most burning questions of the day. The picture of Albert Edward, the Prince of Wales, is the frontispiece, and caricatures of his "royal nibs" adorn other positions of this number. Altogether it is a royal edition, and the prince is favored with a "character sketch" by Editor Wm. T. Stead, who starts off with the prayers constantly offered by the Church of England for the Queen's Majesty and for the Royal Family. And it is calculated that the prayer for the prince has "been said aloud" so many times: "Eight hundred and eighty millions of prayers, and as answer thereto, the Baccarat scandal of Tranby Croft!" The prayers of the A. O. S. E. chaplains are bound to be as fruitful of good works as all that anyhow.

Editor Stead investigated the Church of England prayers jnst as an electrician calculates the effect of an electric cnrrent, or tne capacity of a conductor, and his conclusions are very edifying.

There is much also in the August number. "The Progress of the World" is the leading article, being on Chicago and the World's Fair, and it has been reprodnced in all the leading American newspapers. There are "pictures of Col. Davis and all the leading Fair officials; also photos of other prominent men—ancient and modern.

Among the group of English Congregationalists, the Rev. Dr. Parker, of the London City Temple, very appropriately occupies the central and most honored position.

Marriage is evidently a failure in the O'Shea--Parnell matrimonial alliance, according to the showing of the *Review of Reviews*. Altogether, this monthly publication, which is only 20 cents a copy, or $2. a year, is in touch with the leading movements of human affairs on this mundane sphere, and takes into account the higher as well as the lower environments of men and events.

G. A. R.

The Detroit encampment of the Grand Army of the Republic passed off happily. The reception in the capacious rink was a glorious event. When Gen. Alger (as chairman) called upon Rutherford B. Hayes, once president of the United States, the vast audience reached its highest point of enthusiasm, except when Ex-President Hayes concluded his speech.

"Comrade" Hayes commenced by saying that the limitation of time put upon him was undoubtedly due to tender consideration for the audience as well as for the speaker. It was impossible to discuss any question satisfactorily in ten minutes. But the audience did not want to hear any deep discussion. The music of the flying drumsticks of Mr. Hendershott was more to their taste. President Hayes said that he almost pitied the women and young people that they had never heard the inspiring music of the battlefield which was so vividly illustrated by Comrade Hendershott. The President said that the best test of every effort was to ask, "What has come of it?" He had been looking for years for a single sentence into which could be crowded the results of the war of the rebellion. What had the country gained? As the best expression in a single sentence he would say that "we had gained for onrselves, for the world, for the future, for all mankind, all that it means, the United States of America."

AT THE ENGINE.

How the Brave Men Obey Orders Without Flinching in the Engine Room.

The light from the electric lamps is reflected in patches on the smooth steel beams of the engine. In and ont, in and out, like shuttles weaving, work the rods, their perfect rhythm of motion and precision of movement giving no hint of the great speed at which the giant vessel is cleaving her way.

Days have passed without a signal from above, the engines throbbing steadily. Everything is repose; the incessant motion of the machinery is so common to the men that they do not notice it. The deck may be ever so noisy and these men, buried in the bowels of the ship, would never know it.

Suddenly the great signal gong sounds upon the stillness a single resonant clang—stop. The engineer and his assistants are at their posts in an instant; the engines stop. This, the first signal for hours, yes days, means to them nothing, but that it must be instantly obeyed.

It may be a man overboard; it may be in another instant some vessels prow will cut the ship in two, or the ship itself will crash into an iceberg—they only know their orders; the bell has spoken—stop.

With hands upon the wheels they stood waiting, every nerve strained, in utter ignorance of what the signal means. Soldiers in action see the danger; the officers on deck know what is going on; but these men know nothing but duty.

A moment passes without word in that narrow room. Strong hands are ready for the next order. It comes, "clang, clang," "reverse the engine." The lever is drawn forward, the valves open and obedient to the touch the great piston rods move again.

The seconds seem ages, one, two minutes and then —an awful crash, a grinding and the vessel staggers. "Clang" goes the great gong and still at the posts quick hands stop the engine. "Ting-a-ling-a-ling," "ting-a-ling-a-ling"--"quit the engine," comes the signal.

While confusion has reigned above, these silent men have stood to their posts until this order came. They rush to the deck. The vessel is filling, a great hole in her bow from the collision with the ice, and all hands turn to the life boats.

In the depths of a steamer where that great heart of man's construction beats out the vessel's life, true heroism is to be found, firm, unquestioning obedience to orders.—Henry Pacet in *Short Stories*.

CHARCOAL AS A DISINFECTANT.

Charcoal is one of the best agents for purifying foul water. If cistern water has an unpleasant odor from the cistern being to closely covered it may be made as sweet smelling as when fresh by suspending in the water a muslin bag containing one or more pounds of charcoal according to the size of the cistern. A mixture of powdered charcoal, one pound to four pounds of plaster of paris, sprinkled under porches or in damp corners will prove an excellent disinfectant.

ILLINOIS STATE FAIR OF 1891.

Secretary Garrard, of the state board of agriculture, has issued the following circular:

The thirty-ninth annual Illinois state fair will be held in Jefferson Park, in the city of Peoria, commencing Monday, September 28, and ending Friday, October 2, 1891.

The state board of agriculture refer with pride to the fairs held in the city of Peoria in the past, which have invariably been the most successful ever held in the state of Illinois, if not on the western hemisphere, in point of excellence of the exhibit, the magnitude of the attendance and the bountiful returns for their labors.

To those who have visited the Illinois state fair during the past two years very little need be said, but we desire to impress upon the minds of those who have not, the following points, which will commend themselves at once:

1. The Illinois state fair never scales, rain or shine; all premiums will be paid in cash.

2. The Illinois state fair has been successfully established for thirty-eight years.

3. The Illinois state fair offers $30,000 in premiums and special attractions.

4. The Illinois state fair grounds surpass any in the west for the accommodation of visitors, exhibitors and live stock.

5. The Illinois state fair is the great blue ribbon fair—the supreme court of all the fairs, and is considered by the exhibitors of horses, cattle, sheep, hogs, poultry, machinery, etc., as the highest tribunal of award.

6. The Illinois state fair of 1891 promises to excel any ever held in the state, in number and variety of exhibits, and in interest to exhibitors and those attending the fair.

The city of Peoria is beautifully situated on the Illinois river, is second in population and wealth of the cities of the state, and has a national reputation for the hospitality and enterprise of its citizens. Its railroad facilities are unsurpassed by any city in the state.

Excursion rates of one fare for the round trip will be given on all railroads of the state. Exhibits of every description (except race-horses) will be charged one tariff rate going and will be returned free if no change of ownership has taken place.

Ample provision has been made for reaching the fair grounds.

Regular trains will run every half hour during the day, and three lines of street cars will be run during the day and until midnight, affording a convenient and rapid transit to and from the grounds.

Members of the press, crop correspondents, officers of county organizations and others holding complimentary tickets, will please report at the president's office that the usual courtesies of the Illinois State Board of Agriculture may be extended to them.

The premium list has been carefully revised, and the premiums offered, in many instances have been largely increased over those of the fair of 1890. The entry books will be open at the fair grounds in the city of Peoria, on Wednesday, September 23, 1891.

We confidentially expect to entertain 300,000 people during the week and are making every provision for their comfort.

For further information address

W. C. Garrard, Secretary,
Springfield, Ill.

TO COLORADO VIA BURLINGTON ROUTE.

ONLY ONE NIGHT ON THE ROAD.

Leave Chicago at 1:00 P. M., or St. Louis at 8:25 A. M., and arrive Denver 6:15 P. M. the next day. Through Sleepers, Chair Cars and Dining Cars. All Railways from the East connect with these trains and with similar trains *via* Burlington Route to Denver, leaving Chicago at 6:10 P. M., St. Louis 8:15 P. M., and Peoria at 3:20 P. M. and 8:00 P. M. All trains daily.

Tourist tickets are now on sale, and can be had of ticket agents of all roads and at Burlington Route depots in Chicago, Peoria and St. Louis.

There is no better place than Colorado for those seeking rest and pleasure.

THE LARGEST STEAM HAMMER.

At the Bethlehem Iron Works, Bethlehem, Pa. there is a steam hammer compared with which Nasmyth's was a small affair. The Bethlehem steam hammer is the largest in the world, and the following description thereof comes to us from the New York *Sun*, through *The Locomotive:*—

The hammer building is situated at the extreme eastern end of the works, and covers ground that was formerly an island in the southern channel of the Lehigh River, the river having been turned from its course to make a site for the structure. It is 500 feet long, lighted by windows at the sides and a lantern in the roof, and besides the hammer contains a 6,000-ton hydraulic bending press and an armor-plate rolling mill.

The hammer and anvil foundations are elaborate specimens of masonry. A pit 58 by 62 feet large was excavated deep down below the water-level. Then heavy walls, 30 feet high, were erected on a pile foundation along the northern and southern sides for the hammer frame to rest on.

In the space between these walls is the foundation for the anvil. It consists of piles driven to bed rock, with a timber frame on top, and on that steel and iron slabs arranged in longitudinal and transverse layers. On this the anvil was built. It consists of twenty-two blocks of solid cast iron, of an average individual weight of seventy tons, arranged one above the other, in pyramidal shape. The topmost one, on which the material to be forged will rest, is faced with steel.

The space between the anvil, the frame supporting the hammer, was closed with cribbing, which presents a surface even with the floor line, the only visible portion of the entire mass of oak and iron forming the anvil, which weighs 1,800 tons, being the steel-faced anvil block capping the pyramid. This block is wedge-shaped, being 11 feet long, 6

feet wide at the bottom, and 2 at the top, and 4½ feet high. The hammer and anvil foundations are in no way interlaced; the danger of the anvil foundation giving way is slight, but should it be displaced by the powerful blows, the hammer and its foundation will remain secure.

Superimposed over this cyclopean mass of masonry and iron work is the hammer—huge, substantial, and powerful, rising to the height of 90 feet.

In building the frame which supports the hammer there are first two castings weighing 120 tons each which rise somewhat in the form of a quarter-circle on the inside, but almost perpendicular on the outside, to form an arch curving gracefully over the anvil. The two castings are known technically as housings. The longitudinal width of the hammer frame is 42 feet, and the distance from housing to housing is 22 feet on the floor line inside of the arch. The housings, whose bases are 10 feet by 8, are clamped to the foundation walls.

Above the first arch is a smaller space enclosed by 80-ton castings. These two castings are so constructed as to leave a space ten feet wide in the inside of the frame for the working of the ram or hammer proper. Above these is the steam chest, a large and heavy casting of peculiar shape. The extraordinary number of valve holes, notches, and other indentations which it had to contain, made it the most difficult casting ever turned out here. On top of the steam chest is placed the huge cylinder, 24 feet high, with an internal diameter of 76 inches.

Exactly in the center of the arch formed by the housings is the trip or ram, an enormous mass of metal 19½ feet long, 10 feet wide, and 4 feet thick, the weight of which is almost 100 tons. It is composed of three single pieces, the lowest of which, a large block of iron faced with steel, is called the die. It is the die that will strike the metal being forged. The ram works in slides arranged along the inside of the housings, the castings of the section above the housings.

Connecting the ram with the piston inside of the cylinder is the piston rod, a splendid specimen of perfectly wrought steel, 40 feet long and 16 inches in diameter. The piston has a stroke of 16½ feet; which is the height that the die can be raised above the anvil. The weight of die, ram, piston rod, and piston together amounts to 125 tons. The cylinder is single acting, the steam only lifts the hammer, and then allows it to fall of its own weight. It is when this mass of 125 tons is dropped from the height of 16½ feet that the hammer exerts its greatest power.

The weight of the entire mass of iron and steel used in the construction of the hammer and its frame amounts to more than 800 tons.

Among the hammer's accompaniments for handling ingots and armor plates are the two most efficient and pneumatic cranes ever constructed. They are capable of carrying 300 tons weight each and have a running motion on their trusses, a transverse motion of trolley, a hoisting, a turning, and a rolling motion, besides three or four others. They are apparently able to do almost anything but turn a somersault.

The hammer will be used principally for forging armor plates out of ingots, which are made of steel in the casting department, and weigh from 20 to 100 tons each.

When in operation the hot ingots will be laid on the anvil and held there by the cranes and shifted and turned by porterbars.

The piston will be forced up against the top of the cylinder by the action of the steam introduced into the steam chest by an eight-inch pipe from the boiler house. The steam will then be shut off and exhausted from the cylinder, and the ponderous ram will drop with full force on the ingot. On account of the extraordinary power of the hammer few reheatings will be necessary.

The giant was designed by Mr. John Fritz, superintendent of the works, somewhat after the hammer of Schneider & Co. of La Creusot, France, which, next to this one, is the largest in the world.

Map of the United States.

A large, handsome map of the United States, mounted and suitable for office or home use, is issued by the Burlington route. Copies will be mailed to any address on receipt of 12 cents in postage by P. S. Eustis, Gen'l Pass. Agent, C., B. & Q. R. R., Chicago, Ill.

TRADE NEWS.

Capt. Frederick Pabst, president of the Pabst Brewing Co., Milwaukee, has ordered the Zell improved water tube boilers, for a capacity of 2,100 h. p.. for his new heating and lighting plant.

The Ball Engine Co., of Erie, Pa., have issued a new illustrated catalogue. As is well known, the Ball Company manufacture simple, tandem compound, cross compound, and triple expansion engines, and they are extensively used in electric lighting stations, electric railway power houses, as well as general manufactorics. The new catalogue is well printed, on good paper, and the engravings show up first-class.

On the 8th inst. the Ball Engine Co. shipped eight car loads of machinery to the Key West Gas & Elect. Lt. Co., of Key West, Fla., consisting of three large engines, two boilers, pumps, heaters, condensers, etc. The Key West Elect. Lt. Co. will build one of the most complete plants in the South.

"Modern Home Heating" is the subject of an illustrated catalogue, pertaining to the coming season, issued by the Herendeen Manufacturing Co., of Geneva, N. Y., who are the sole makers of "The Faultless Furman" steam and hot water boilers. This is the 1891-92 edition of the catalogue. Beside a technical description of the Furman boilers, an effort has been made to give practical information on how to correctly proportion radiation, and how to find the cost of an apparatus complete, together with suggestions on ventilation, and on the placing of radiators, as well as several useful tables and plans for piping houses (for heating).

CONTRACTS OPEN.

Water-Works.—Sealed proposals will be received by the Chairman of the Water Supply Committee to build a system of water-works for this place, Gainesville, Fla., according to plans and specification on file. Bids will be received and opened on September 1, 1891. The committee reserves the right to reject any or all bids. For copies of plans and specifications and any further information address

A. J. McArthur, Chairman Water Supply Committee.

Steam Heating.—Sealed proposals addressed to A. P. Wooldridge, Secretary of Board of Regents of the University of Texas, will be received until 12 o'clock, noon, August 22, 1891, at Austin, Texas, for the erection of a steam heating plant for the university. Plans and specifications can be seen at office of Burt McDonald, at Austin, Tex., or they will be sent to bidders upon a deposit of $5, guaranteeing their return. Right is reserved to reject any or all bids and a certified check for $300 must accompany each bid.

Burt McDonald, Architect.

Water-Works.—Sealed proposals will be received until noon of Tuesday, August 18th, 1891, by the Trustees of Water-Works of Eaton, Ohio, for the following items for the Eaton Water-Works:

Eight hundred and sixty-five (865) tons of cast-iron water pipe, ranging from four (4) to twelve (12) inches diameter.

Thirty-two thousand nine hundred and five (32,905) pounds of special castings for above pipe.

Seventy-four (74) four (4) inch double-nozzle fire hydrants.

Fifty-nine (59) stop valves, from four (4) to twelve (12) inches diameter, and fifty-nine (59) stop boxes for above valves.

Laying of above pipe and setting of above special castings, fire hydrants, stop valves and stop boxes.

Brick pumping station and brick chimney.

Two (2) compound condensing, duplex, direct-acting pumping engines, each of seven hundred and fifty thousand (750,000) gallons daily capacity, together with two return tubular boilers and all appurtenances necessary to complete said machinery.

One (1) steel stand-pipe twenty (20) feet in diameter and eighty (80) feet high.

Ranged rubble foundation pier for stand-pipe.

Proposals must be made on the blank forms furnished by the Trustees of Water-Works, and all legal formalities must be complied with to secure consideration of the proposals.

The preliminary bond and date of furnishing materials and completion of work must be filed to constitute a formal proposal.

Plans of above work may be examined and blank forms of proposal and specifications can be obtained at the office of the Trustees of Water-Works, Eaton, Ohio, or the office of the Engineer, rooms 21, 22 Glenn Building, Cincinnati, Ohio.

The proposals must be sealed and addressed to the Trustees of Water-Works, Eaton, Ohio, and be indorsed with the name of the person, firm or corporation which makes the tender and be accompanied with certified checks payable to the order of the Trustees of Water-Works as follows:

Water pipe and special castings	$300
Fire hydrants	250
Stop valves	200
Pipe laying	300
Pumping station and chimney	200
Pumping machinery	300
Stand pipe	300
Stand pipe foundation	200

The Trustees of Water-Works reserve the right to reject any or all proposals.

Wm. C. McCabe, Herman Sanders, Andrew Heistand, Trustees of Water-Works, John W. Hill, Engineer, Cincinnati, Ohio.

Eaton, Ohio, July 20th, 1891.

Pumping Engine.—Sealed tenders will be received at the office of the Board of Water Commissioners, Woodstock, Ont., up to and including Saturday, Aug. 15, 1891;

1. For the furnishing and erection of a steam pumping engine of 2,000,000-gall. capacity.
2. The furnishing of pipe and laying of an 18-in. earthenware conduit about 17,000 ft. in length.
3. For furnishing hydrants and valves required in the distribution system.

Specifications and all information pertaining thereto can be obtained from the engineer, W. M. Davis, Woodstock.

The Board reserves the right to reject any or all bids.

All tenders to be addressed to the undersigned.

Geo. C. Eden, Sec'y of Board.

Water-Works.—Sealed proposals will be received by the City Council of the City of Washington, Washington County, Iowa, until 12 o'clock noon of the 17th day of August, 1891, for furnishing material and constructing water-works in said city.

The work to consist of a building, storage reservoir of 30,000 gallons capacity, one standpipe 14x110 feet, one artesian well pump, two duplex pumps, capacity of 600 gallons per minute each; two boilers, 50 horse power each; 380 tons cast-iron pipe, about 10 tons specials, 38 hydrants, 20 gate valves.

Bids will be received for the whole or any particular branch or subdivision of the work and materials at the option of the bidders.

Full drawings may be seen in the office of the City Clerk at Washington, Iowa, or in the office of Geo. W. Wynn, Consulting Engineer, at Cedar Rapids, Iowa.

For copies of specifications and form of proposals address J. J. Kellogg, City Clerk, Washington, Iowa.

The right to reject any or all bids is reserved.

J. G. Hise, Mayor. F. E. Lamphere, W. S. Reister, Frank Stewart, Aaron Hise, W. N. Hood, Water Committee.

Water-Conduit.—Sealed proposals will be received by the City of Savannah, office Water-Works, Savannah, Ga., until eleven (11) o'clock a. m., Aug. 26, 1891, for the construction of a Water Conduit of masonry, on masonry and timber, having an internal diameter of approximately six (6) feet and a length of three thousand (3,000) feet, more or less, all to be in accordance with general specifications on file in the Water Office at Savannah, Ga., or which, with other information, can be obtained from Thos. T. Johnston, Consulting Engineer, at Room 29, No. 171 La Salle St., Chicago, Ill. Proposals must be made in accordance with aforesaid general specifications. Proposals must be accompanied with a cash deposit of two thousand ($2,000) dollars or a certified check for two thousand ($2,000) dollars drawn in favor of the properly authorized agent of the City of Savannah, to be returned or retained in accordance with the general specifications. No proposal will be entertained unless the party furnishing it can offer evidence satisfactory to the Mayor and Board of Aldermen of the City of Savannah of his ability, and that he has the necessary facilities, together with pecuniary resources, to fulfill the conditions of the contract and the specifications, provided such contract should be awarded to him.

The right is reserved to reject any and all proposals not deemed to the best interests of the city.

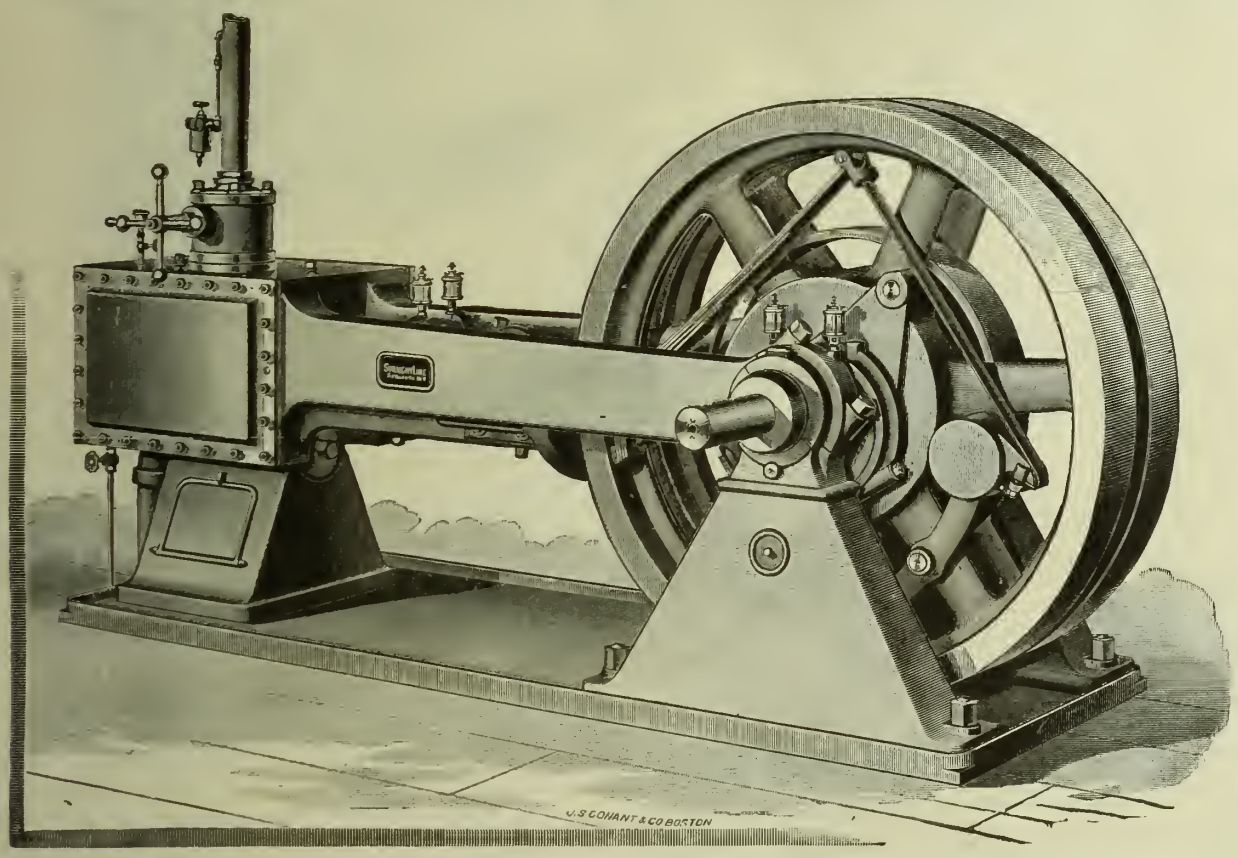
James Manning, Superintendent.

STRAIGHT LINE DOUBLE VALVE ENGINE.

The double valve engine, shown in the accompanying electroplate, (on this page) and put on the market by the Straight Line Engine Co., of Syracuse, N. Y., differs from all others. Hence an explanation of its design and operation cannot fail to be specially interesting.

The plan of this engine conforms with two leading ideas, namely, that all strains go in straight lines, and that any structure having considerable length and breadth, in proportion to its depth, must be supported on three self-adjusting points of support, to be free from torsion when resting upon an unstable foundation. Absolutely solid foundations are rare and costly; but however much one may "settle," or go out of true, if the machine rests on three points, it will in no way be sprung or warped, we are positively assured. And again, if the foundation is absolutely unyielding, the three points of support are still correct. It is also well to bear in mind that when a line of strain passes directly through the center of the bar that resists it, there is no tendency to spring or bend the bar; but where the strain is resisted by a curved frame, there is always a tendency to spring.

The design of this engine is believed to be consistent in that all boundary lines are straight, ending in graceful curves; all cross sections of stationary parts rectangular, with rounded corners; and all moving arms and levers, double convex, wide and thin, with the longest axle in the direction of the greatest strain. Thus the designers have kept "the fitness of things" well in view.



The frame of this engine is cast in one piece with the cylinder and steam-chest. While this proves to be an expensive way, it has the merit of remaining true if once made so, it is said, and the form being such as to place the metal in the best possible position to resist the strains, and as the amount of metal is enormously in excess of that required, it is believed no occasion will arise when any one having one of these engines will wish it made otherwise.

The objection has been raised that additional expense will be incurred when it becomes necessary to re-bore a cylinder; but provisions are made for re-boring, by which the work can be done more cheaply than in ordinary engines where the cylinders are removed and mounted on a lathe—it is maintained. And no wear can take place at the main journals; provision is made for facing the valve seats without interfering with the valve adjustment; the lower guide for the cross-head is a separate casting, so no wear comes on the frame except in the bore of the cylinder.

The throttle valve of this engine, which was designed by the late John Coffin, formerly foreman of the Straight Line Engine works, consists of a flat seat, circular in form, having a semi-circular opening through it, and a valve whose face is a counterpart of the valve seat, which may be rotated half way round by means of a semi-circular bevel gear upon its surface and a pinion. When the valve is set in such a position that the two openings coincide, there is a straight way passage for the steam, and when turned in the reverse way the valve is closed. There is no face exposed to the action of the steam when the valve is open, and when reversed, none exposed to rust. Thus, protected from both the action of steam and rust, the faces remain perfect and steam-tight for a long time after the warp by changes of temperature has been taken out. The faces being flat, they can be refitted by either scraping or grinding, more readily than any other form. The pinion, by which the valve is rotated, is cast on the stem, and that made a steam-tight joint by a good fit of the stem and a ground joint at the shoulder, or packed in the usual way. The threads on the bush which screws in the casing being larger than the pinion, the whole handle arrangement is removed together for shipment.

The Straight Line Engine Co. have made a new departure in piston construction. The main characteristic is that the packing rings are of what they have designated "limited expansion," that is the rings are made much too large for the cylinder, and then sprung in with considerable force, being pinned in that position and the outside turned to a perfect fit to the cylinder. The pin-holes in the rings are afterward fitted to admit of the rings being compressed while not allowed to expand. Engines smaller than ten-inch cylinder are solid with rings sprung in.

The piston rod packings are simply Babbitt metal bushings, with reamed holes slightly larger than the rods, so as to be a free sliding fit. But when specially requested the manufacturers used hemp packing instead.

The cross-head, which is of steel or malleable iron casting, is threaded on the piston rod and secured by being split and clamped by the binding bolts. The wearing surfaces of the steel castings are faced with babbitt. The cross-head pin is a hollow steel casting made fast to the connecting rod and turns in two adjustable babbitt-lined boxes in the cross-head. The object of this is to secure lightness, extra wearing surface, to prevent side swinging of the connecting rod at the fly wheel end, and to give ready means of oiling. The method of oiling is by two fixed sight feed oilers without wicking. The oil from the metal points is taken off by metal channels and conveyed to the cross-head pin from which the drip is conveyed to the lower guide, and all waste oil and water is retained in the baisin, or conveyed away in an overflow pipe. The rods are secured to the cross-head pins by clamp bolts and the crank boxes are hammered babbitt metal bored and scraped to fit. Test pins of considerable length, ground to perfect cylinders, are put in each end, and the holes tested for parallelism and truth, and scraped until perfect accuracy is secured.

The steel crank pin and shafts forced into the large bosses of the two wheels form a solid structure, dividing the strain equally between the bearings, and giving an opportunity to balance the reciprocating parts properly, while furnishing a support for the governor and relieving the main bearings of a good part of the thrust of the piston. The crank pin is oiled while the engine is in motion by means of the eccentric chamber on the outside of one of the balance wheels and the holes drilled through the crank pin. The waste oil from the inner end of one of the main bearings finds its way to the crank pin also, so that the main bearing is sure to run dry before the crank pin does. The wearing surface of the crank and main journals are made exactly of the same length as the wearing surface in the babbitt-lined boxes, and as the main shafts and crank have one-quarter inch play through the boxes, grooves are turned in the shafts and cranks, so that the boxes can over-run. The ends of the shafts are reduced to the size of standard shafting, one size smaller than the bearings. The waste oil thrown from the cranks of high-speed engines has always been source of great annoyance, and one which the Straight Line Engine Co. say they have succeeded in pretty effectually overcoming by recessing the inner surface of the wheel rims so as to catch the oil and there retain it until the engine is stopped, or from which it can be wiped while the engine is in motion.

Details of the main journal boxes, and of the governor, eccentric, valve motion, and the valve, together with the exhaust, pedestals, etc., are given, with illustrations, in the company's illustrated catalogue, which may readily be obtained by those interested.

This article cannot be concluded better than by giving the "pedigree" of this engine. It was built as an experiment in 1871. A second "edition" appeared at the Cornell University in 1875, where it is still used experimentally. In 1879 the first engine was changed by the introduction of a governor of the present form, and on January 1, 1880, an upright rolling mill engine was built by Sweet's Manufacturing Company, which has been in constant service since. On February 1, 1880, the Straight Line Engine Company was organized, since which time they have been building the engine known by this name.

While this engine has always maintained the original characteristics, that is, a frame consisting of two straight arms running from cylinder to the main bearings with the balance wheels between, and the whole resting on three self-adjusting points of support; they have, from time to time, made such changes as experience indicated would make a more perfect machine. Many of the changes have been in the direction of simplicity, and all to make it more complete.

At the works of the Straight Line Engine Co., during the A. O. S. E. convention, the engineers were shown one of the company's new double valve 100 h.p. engines on the testing floor under steam with both indicators and prony brake in operation. As steam was taken from the boiler running the works, only enough for sixty horse power was available, and with this load on the prony brake, while the engine was running 220 revolutions, by a trip on the brake, the entire load was thrown off instantly. When this was done no possible variation in speed could be detected, and except for a change in sound of exhaust, which seemed to change at the same instant, no one could possibly detect that the load had been removed. During the time the load was thrown off the indicator pencils were held on the papers and in some cases only two and in others three intermediate lines appeared on the cards, showing that the governor changed its position as

readily as the increase in the speed of the wheels. The change from loaded to light was a trifle less than 2%. The governor can be set to govern at any degree of sensitiveness, but 2% is considered by builders to meet practical requirements.

Another experiment shown, that interested the engineers quite as much as the foregoing, was starting the cards with the engine running light, holding on the pencils and then applying the load gradually, or as nearly so as could be done by the operator screwing up the prony brake with an open end wrench. Time did not permit seeing the large number of interesting and novel things which this company always takes special pains to show and explain.

We received cards taken by some of the visiting engineers, while at the Straight Line Engine Works. But as neither of them showed the action with the load removed, we applied to the company for such a card. Not having an engine of the same kind on the testing floor they sent us one taken from a single valve engine, in addition to the one previously received.

Fig. 1 shows card from the double valve engine, 14x16 running 220 revolutions, with the engine running to speed light and an increasing load up to 60 h.p., applied by screwing up prony brake.

Fig. 2.

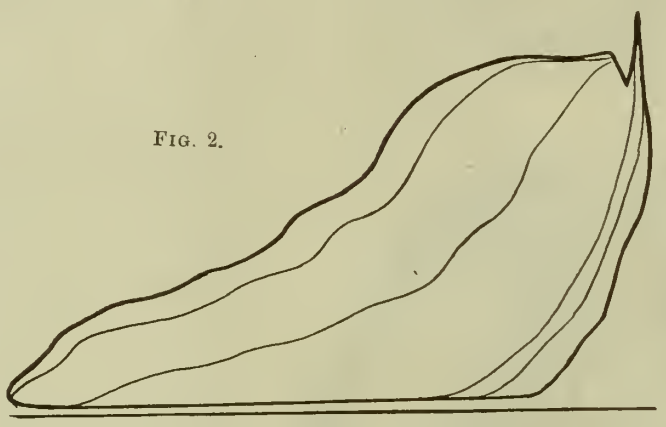


Fig. 1.

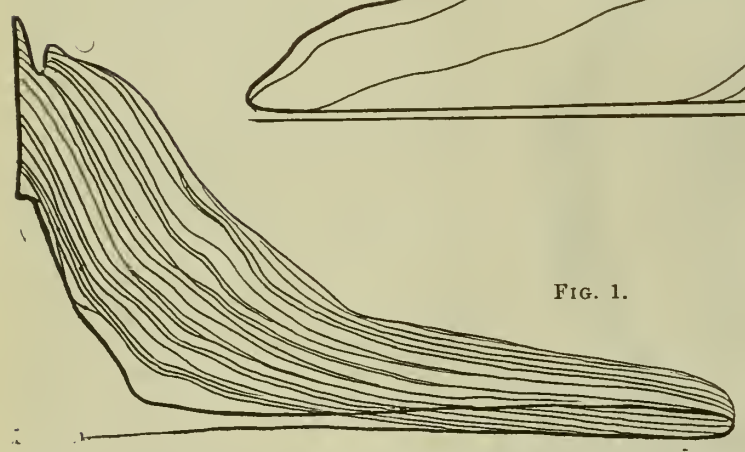


Fig. 2 shows single valve engine, 11x14 running 275 revolutions, with 70 h.p. load with prony brake thrown off instantly to 25 h.p., the brake not having slack enough to throw the load entirely off.

THE INSPECTION OF STEAM BOILERS.*

Let it be clearly understood that if there were no steam generators using steam under pressure there would be no boiler inspection, and no licensing of engineers; it requires no license to be a machinist or a machine tender, no more would a license be essential to run a steam engine, except it were connected with the boiler. The danger to the public arising from their use requires that the care and management of high pressure steam boiler shall be in hands of careful, experienced and naturally ingenious men, hence it is on the affairs of the boiler room that the first tests are made, as to the worthiness of an aspirant for an engineer's license, hence too, the success of many firemen in obtaining the preference over engine-boilers or school graduates, in the line of promotion as steam engineers.

The inspection laws of the various states and cities are framed after substantially the same leading ideas, and in presenting one, the others may be assumed to be nearly the same.

The special province of the Steam Boiler Inspection and Engineers' Bureau in the police department, in New York City, is to inspect and test all the steam boilers in the city, at certain stated periods, and to examine every applicant for the position of engineer as to his ability and qualifications for running an engine and boiler with safety.

According to the laws of the State, every owner, agent or lessee, of a steam boiler or boilers, in the city of New York, shall anually report to the board of police, the location of said boiler or boilers, and, thereupon, the officers in command of the sanitary company shall detail a practical engineer, who shall proceed to inspect such steam boiler or boilers, and all apparatus and appliances connected therewith.

When a notice is received from any owner or agent that he has one or more boilers for inspection, a printed blank is returned to him stating that on the day named therein the boilers will be tested, and he is asked to make full preparation for the inspection by complying with the following rules:

Be ready to test at the above name time.

Have boiler filled with water to safety valve.

Have 1½ inch connection.

Have steam gauge.

Steam allowed two-thirds amount of hydrostatic pressure.

More particularly stated, the following have been adopted by one or more Inspection Companies.

How to Prepare for Steam Boiler Inspection.

1. Haul fires and all ashes from furnaces and ash pits.

2. If time will permit, allow boiler and settings to cool gradually until there is no steam pressure, then allow water to run out of boilers. It is best that steam pressure should not exceed ten pounds if used to blow water out.

3. Inside of boiler should be washed and dried through manholes and handholes by hose service and wiping.

4. Keep safety valves and gauge cocks open.

5. Take off manhole and handhole plates as soon as possible after steam is out of boiler, that boiler may cool inside sufficiently for examination; also keep all doors shut about boilers and settings, except the furnace and ash pit doors. Keep dampers open in pipes and chimneys.

6. Have all ashes removed from under boilers, and fire surfaces of shell and heads swept clean.

7. Have spare packing ready for use on manhole and handhole plates, if the old packing is made useless in taking off or is burned. The boiler attendant is to take off and replace these plates.

8. Keep all windows and doors to boiler room open, after fires are hauled, so that boilers and settings may cool as quickly as possible.

*From Maxims and Instructions for the Boiler Room, Part V. Published by Theo. Audel & Co., 91 Liberty St., New York. Price 25 cents each of ten parts.

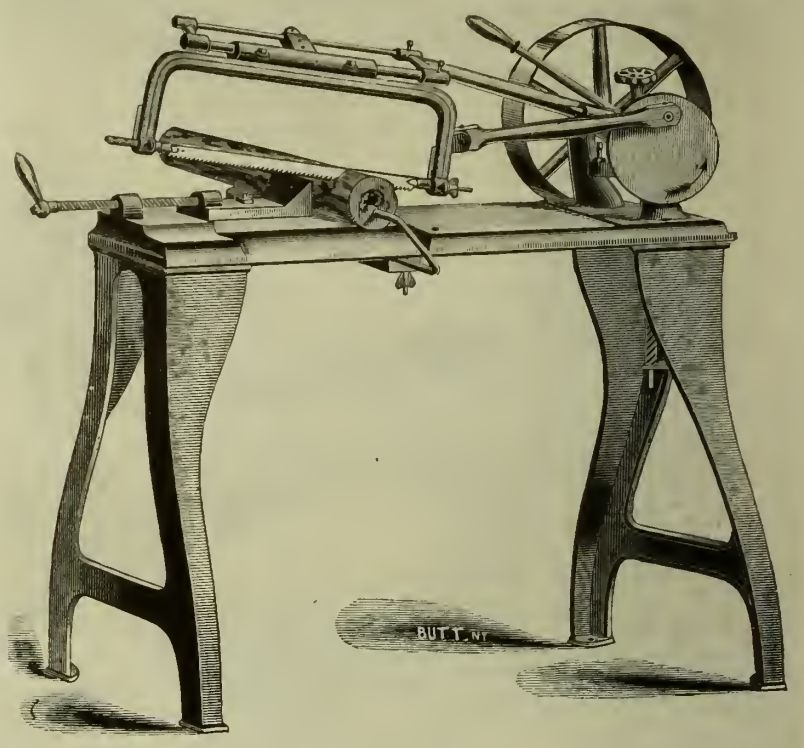
INTERNATIONAL ELECTRIC EXHIBITIONS, FRANKFORT, GERMANY, 1891.

The work of transmitting 300 h. p. at a distance of 120 miles upon the line Lauffen-Frankfort, which was begun about the middle of July, is progressing very favorably. On the line Frankfort-Jagstfeld which is being built by the Imperial government, light gangs of workmen are busily engaged whilst three gangs are working on the Wurttemberg side. The vast material necessary for the building of the line, consisting of especially constructed telegraph poles, cross-bars and insulators having arrived on the spot in good time, and aided by the practical and energetic measures of the employes engaged upon the work, nearly all the telegraph poles along the whole line are in their places, in spite of unusual difficulties connected with the mountainous nature of the soil having had to be surmounted. Thanks to the exertions of the firm of Hesse Sohne, Heddernheim, who delivered the necessary quantity of above 1,200 tons of copper wire at the respective places within the space of a few days. Not less than 750 kegs of oil will be necessary to fill the insulators. There is now every reason to believe that the three wires of about 120 miles each will be fixed and in working order before the end of August.

POWER HACK SAW.

The Millers Falls Co., 93 Reade street, New York, recently placed a useful power hack saw, of which the cut in this column is an illustration, on the market.

This saw, as seen in the cut, is made to run with a belt, and is adapted to their 10, 11 and 12 inch star hack saw blades. One blade used in this frame will do ten times as much work as is usually done with it by hand, it is claimed, as the speed and pressure are regulated and uniform. One blade will cut off a steel shaft five inches in diameter several times. It runs forty strokes per minute, and does its work without attention. The material to be sawed is held firmly in the clamp, and the saw works clear of the top of the bench frame.



The manufacturers are using five of these machines in their own factory, and would not do without them for many times their cost, they say. Others who are running them feel the same way, by all account.

THE NATIONAL ASSOCIATION OF FIRE ENGINEERS.

The association held a convention at Springfield, Mass., last week. They elected these officers: President, A. P. Lesnure, of Springfield, Mass.;—vice presidents, Alabama, H. T. Muller; Tennessee, Charles Whiteside; Kentucky, Edward Hills; Missouri, G. C. Hale; Kansas, A. G. Waldem; Ohio, M. E. Crowfoot; Illinois, James O. Hill; Michigan, L. E. Bentley; Indiana, H. M. Godfrey; Iowa, G. M. Kellogg; Wisconsin, F. M. French; Minnesota, John Jackson; Nebraska, J. J. Gallagan; Colorado, Julius Pierce; Texas, Don B. Adams; Secretary, H. A. Hills; Treasurer, D. C. Larkin.

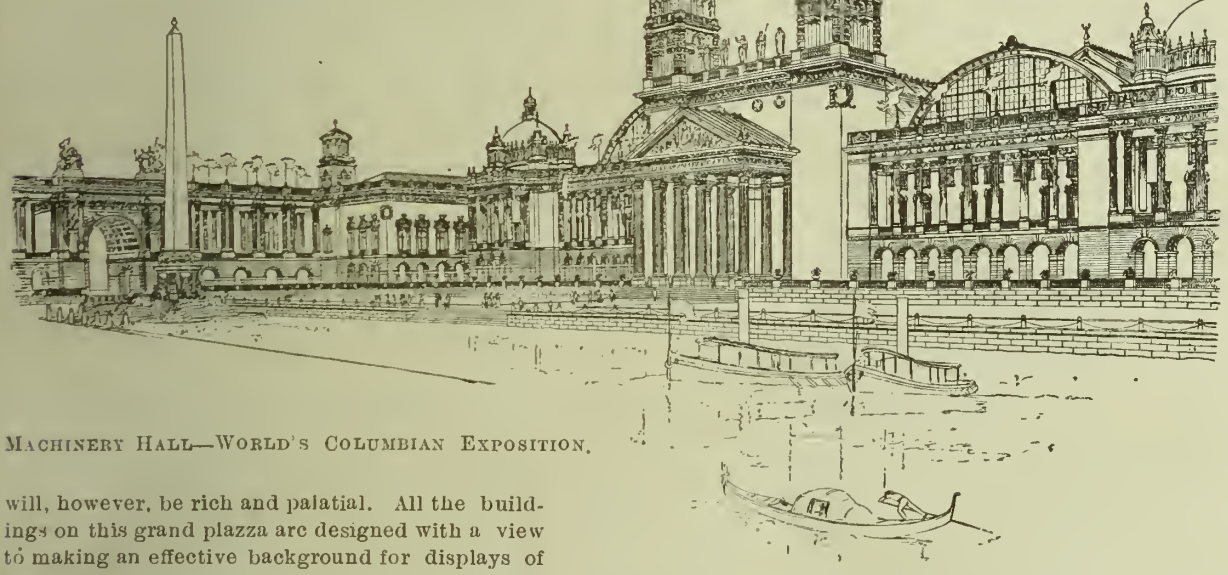
The salary of Secretary Hills was increased to $800, and it was voted to recommend him to the managers of the Columbian Exhibition in 1893 as superintendent of the fire department exhibit.

WORLD'S COLUMBIAN EXPOSITION.

Machinery Hall.

The accompanying cut represents the machinery hall for machinery exhibits at the World's Fair. From figures received from Chief Burnham (of the Construction Department), through the Department of Publicity and Promotion, it appears that the Machinery Building, which is already in course of construction, will occupy ground space measuring 850 by 500 feet, as stated in a previous article which we published,* with map. This building is to be spanned by three arched trusses, and the interior will present the appearance of three railroad train houses, side by side, surrounded on all the four sides by a 50-foot gallery. The trusses are to be built separately, and so that they can be taken down and sold for use as railroad train houses, and it is hoped to have iron trusses instead of cheaper ones, which may, however, be necessary. In each of these three long naves there is to be an elevated traveling crane, running from end to end of the building. These will be useful in moving machinery, and when the Exposition opens platforms will be placed on them, and visitors will view from these the entire exhibition, at a great saving of tramping.

Shafting for power will be carried on the same posts which support these traveling bridges. Steam power will be used throughout this main building, and this steam will be supplied from a main power house adjoining the south side of the building. The exterior towards the stock exhibit and the railroad is to be the plainest description. On the two sides adjoining the grand court, the exterior



Machinery Hall—World's Columbian Exposition.

will, however, be rich and palatial. All the buildings on this grand plazza are designed with a view to making an effective background for displays of every kind, and in order to conform to the general richness of the court, are enriched with colonnades and other architectural features.

The design follows classical models throughout, the detail being borrowed from the Rennaisance of Seville and other Spanish towns as being appropriate to a Columbian celebration. As in all the other buildings on the court, an arcade on the first story permits passage around the building under cover; and as in all the other buildings the fronts will be formed of "staff," colored to an ivory tone. The ceilings of the porticoes will be emphasized with strong color.

A colonnade with a cafe at either end forms the connecting link between Machinery and Agricultural halls and in the center of this colonnade is an archway leading to the exhibits. From this portico there will be a view nearly a mile in length down the lagoon, and an obelisk and fountain placed in the lagoon between the two buildings, Agriculture and Machinery, will form a fitting southern point to this vista.

The machinery annex will be placed in the rear of the Administration building and in the loop formed by the railroad tracks, as stated in our previous article. It will be entered by tunnels or subways, as well as by bridges, from Machinery hall, and the buildings for Administration, Mines and Transportation. It is to be a very large but very simple building. While in the main Machinery building a railroad train house is the type, in the annex a mill or foundry will be considered the model for construction. It is all to be built of wood in the most simple and economical manner. Its shape, however, is peculiar. It is to be annular in form, the outer diameter being 800 feet and the inner diameter 400 feet. The building will have a nave 100 feet wide, with a 50-foot wide leanto in one story on the inside, and a 50-foot wide leanto on the outside. Within the inner circle will be a park in which visitors fatigued by the hum of machinery may rest. The annular form chiefly commends itself because a circuit electrical railway can run continuously around the entire main nave, and passengers in it can thus see the entire exhibit without leaving the cars; and machinery can be easily moved by this means. The power will be transmitted by shafting crossing the building at each bay, with a motor at each shaft. The electrical power will be used in the annex, and the steam power in the main Machinery building.

Attached to this great annex will be the power house, convenient to the tracks for coal supply, etc., containing an immense display of boilers, while in the adjoining portion of the annex building will be established the enormous plant of engines and dynamos. This will probably be the largest and most interesting display of electrical power ever made. It is possible that gas will be used instead of coal for fuel beneath the boilers, and in that case a building will be prepared for making this gas. Some figures giving an idea of the enormousness of this proposed power plant were given in our last issue. (page 64.)

There was a little hitch in the Construction Department last week. The Commission thought the Directory had overstepped its rights by authorizing Chief Burnham to contract for engines. On Monday, however, everything was smoothed over, and the engines contracted for will soon be in place. Part of the contract is that these engines will be "on exhibition" while furnishing power, when the Exposition opens.

The following important resolution was passed by the Board of Control of the Commission:

Resolved, That it is the judgment and opinion of this board, and it is hereby—in so far as it may lawfully do so—declares that the fact of such boilers, engines, or other machinery or appliances as shall be procured and located by the directory of the World's Columbian Exposition, being by them devoted to the supply and distribution of adequate power, light, and heat for the exposition buildings, shall not preclude the entry of the same by the owners thereof as competitive exhibits in the classes to which they may severally belong, subject, however, as to the classification and installation thereof, to the rules and regulations prescribed by authority of the National Commission.

A Chicago saloonkeeper has failed. He is suspected of having conformed to the law.—*Boston News.*

*See the American Engineer for April 18, 1891

STRENGTH OF BOILERS.

The tendency of the pressure within a steam boiler is to force the material into the shape of a perfect sphere. Experiments have been tried by making models of various shapes of steam boilers of an elastic material, such as rubber, and then pumping air inside so as to produce pressure of any desired amount and noting the effect in altering the shape. By this plan the theoretical calculations have been tested and proved to be correct.

In a cylindrical boiler the ends, if made hemispherical, will require no stays, but if flat, must be stayed in order to enable them to resist the same pressure as the cylindrical part. In a cylindrical boiler of any given diameter, the strain tending to rupture the shell depends upon the diameter and the pressure, and is found by multiplying the pressure and diameter together. In making such calculations, it is absolutely necessary that the same standard of units be used. If the pressure be taken in pounds per square inch, then the diameter must be measured in inches, and it will be found convenient to assume one inch as the length of the strip of the shell, the strain upon which is to be calculated.

Let the shell be sixty inches in diameter, and the pressure one hundred pounds per square inch, what is the strain produced tending to rupture the cylindrical shell? Sixty pounds × one hundred is six thousand pounds. This, however, bears equally on two sides of the shell, tending to break the cylindrical hoop into two equal parts; hence the strain on each side is three thousand pounds. Had the cylinder been thirty inches diameter instead of sixty, the strain produced by the same pressure would only have been one-half that amount. It is important here to consider what is meant by apressure of 100 pounds per square inch. It is 100 pounds and the pressure of the atmosphere, or about 115 pounds, but as the pressure of the atmosphere is on the outside as well, it is ususally left out of the count.

Experiments are now being made with a steam boiler formed of one shell within the other. Each contains its own supply of water, and has its own safety valve and connections. In the inner one the steam pressure used is 500 pounds per square inch, in the outer one it is 200 pounds. By this means the pressure producing strains on the plates of the inner one is reduced to 300 ponnds, and as it is smaller in diameter than the outer shell, the total strain on each shell may be made the same.

In the boiler sixty inches diameter 100 pounds pressure as shown on the steam guage was shown to produce a strain of 3,000 pounds on each inch of the length of the shell. What is there to resist this? The thickness of the plate, or rather the amount of metal left after the rivet holes have been made on it.

In single riveted seams the strength may be taken at one-half that of the solid plate, and in double riveted seams at seven-tenths of the solid plate. If the plato be three-eighths of an inch thick and the strength of the plate 60,000 pounds per square inch, then the strength of the double riveted joint will be $60{,}000 \times \frac{3}{8} \times \frac{7}{1} = 15{,}750$. The strain was found to be 3,000, and the strength to resist it 15,750, or a little more than five times. This is a very common difference and is called the factor of safety. It is common to have in new boilers a factor of safety of 6, or 5 or sometimes 4. The necessity for having such a difference between the strength and the strain arises from imperfections in workmanship, and uncertainty as to the actual strength of the particular plates.—*Canadian Electrical News.*

Electrical coal cutters are rapidly replacing hand labor in many mines. Not only is it possible to do the work more cheaply, but there is a decided saving of coal, due to the small height of the undercut.

The American Engineer.

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TO WHOM IT MAY CONCERN.

This is to certify that THE AMERICAN ENGINEER, of Chicago, Ill., is the only duly authorized official organ of The American Order of Steam Engineers.

JEFFERSON YOUNG, JR.
Supreme Chief Engineer A. O. of S. E.

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Contents of this Number.

WORLD'S FAIR MACHINERY AND MANUFACTURES BUREAUS.

In another part of this issue we give a view, with full description, of the Machinery Building that is being built on the Exposition grounds.

The Machinery Bureau is now in full swing, Mr. L. W. Robinson, of the United States Navy, having been appointed its Chief.

Mr. James Allison, of Cincinnati, has been appointed Chief of the Department of Manufactures. This appointment caused some surprise, inasmuch as Mr. Allison is not very prominently known (hitherto) in the mechanical world. But he may be the best man for the place, for all that. The *American Machinist* (laboring under the supposition that Mr. Allison is Chief of the Machinery Bureau) has no hesitation in expressing regret that a man with full knowledge of machinery, combined with administrative ability, was not found and appointed, instead of a plumber, as Mr. Allison is described.

They say: "Mr. Allison, according to a published account, the correctness of which has been certified to us, was apprenticed early in life to a plumber, and after serving one year of his apprenticeship, went into the army, finishing his term of apprenticeship at the close of the war. He became a foreman plumber, and finally a partner, afterwards going into the business for himself—a business in which he is now interested. He is president of the National Association of Master Plumbers, president of the Ohio Mechanics' Institute, member of the Board of Commissioners of the Cincinnati Industrial Exposition, and in 1888 was elected president of this board. He took a prominent part in the work connected with the celebration of the Ohio Centennial celebration.

"His election to the various positions named above indicates, of course, that, in Cincinnati, where they certainly know what executive ability is, he is considered to possess it in a marked degree, and it is this quality which is most needed for such a position as that to which he has been appointed. We must confess, however, that it is a matter of some regret to us that this executive ability was not found associated with other and different experience and training than that of a plumber, no matter how excellent a one. In other words, we would have much preferred that the man selected should have been identified with machinery, and that he should have been trained in a machine shop rather than in a plumber's shop."

According to our contemporary's own showing, Mr. Allison is president of the Ohio Mechanics Institute, and thus evidently is well known to the mechanics of that state. The fact that he has made his fortune in the plumbing business does not prove that he is not well acquainted with machinery in general. And certainly he is a man with plenty of exposition experience. And inasmuch as he does not seem to be personally interested in any firm manufacturing machinery, he will be free from temptation, and the slightest suspicion of unfairness or partiality to friends.

By this time the World's Fair authorities have had experience in making appointments. And, taking into consideration all the circumstances, they have probably made a wise selection in Mr. Allison.

A NATION OF MACHINISTS.

As the Britishers have been called a nation of shop-keepers, the Americans (of the United States) may well be called a nation of machinists and users of machinery. It is no wonder therefore that the Machinery Hall, of the Columbian Exposition, will be the largest ever built for such a purpose; and it is the largest of all the proposed buildings on the World's Fair grounds, except that of the department of Manufactures and Liberal Arts.

The question has been raised in some quarters, and several letters of enquiry have been addressed to the World's Fair authorities, we understand, as to whether it will be permissible to show machinery in motion. We are informed that manufacturing operations will be allowed in Machinery Hall (and elsewhere) as far as that may be necessary in order to exhibit certain machines properly. This is very satisfactory. And, taking all things into consideration, it is not necessary for one to be a prophet in order to be able to perceive that there will be such a show of machinery, when the time comes, that will make the whole world wonder, and truly say that the like was never seen before.

The machinery, on that occasion, will afford a most wonderful show in itself. And when we remember that the department of electricity (which really comprises a new class of machinery) will make an exhibit that will eclipse all others, to say nothing of the department of transportation, and the separate exhibits of States and various countries, it will be no wonder if the "whole world" should be attracted to Chicago in 1893. So be it.

"SEE THAT YOU GET IT."

At the National Editorial Convention, recently held at St. Paul, Minn., Mr. A. Frank Richardson, a prominent newspaper man, called attention to the deception practiced through some retail druggists. And a great howl has gone up, as all who read "the papers" must have noticed.

Mr. Richardson mentioned that "standard" patent medicines are being imitated, or "substituted" very extensively. Say Hood's sarsaparilla, for instance. This is an article of some good, to say the least; some maintain that it is all that its vendors claim it to be. And it is well advertised. A mean party discovers an opportunity to fool the public by manufacturing a worthless substitute for this, and the retail druggist gets the imitation at one-fourth the price he pays for Hood's genuine article. Thus he is enabled to sell it for much less, and make a bigger profit at the same time.

A customer calls on his druggist, and asks for a bottle of Hood's sarsaparilla, which he knows costs $1. The druggist says he hasn't got Hood's, but he has something quite as good, or better, that is Hootes' sarsaparilla, which is only 80 cents per bottle (the same size as Hood's). The druggists makes 40, or 50 cents for himself out of the substitute, whereas he would only gain 25 cents, or less, by selling the genuine article. That is only a specimen of what is being done extensively, they say, with many well-advertised articles.

If a man advertises entensively the article he has to sell must have some merit, at least. And when a man gets what he really wants, as per advertisement, the retail dealer is free from blame anyway, even if the article be not so good as represented in the advertisement. But when a man asks for one thing, and the retail dealer persuades him to take something "quite as good" but which is really worse than worthless, and does harm instead of good, then the retailer is guilty of conspiring with the manufacturers of the spurious article to defraud the owner of the genuine article and to deceive the public.

It is said that a trick of that kind is not illegal. But we don't see why the statute of frauds in Illinois, for instance, cannot be effectively applied. Anyway the evil is here, and it behoves the public to be on their guard. When you go for anything, see that you get it, and don't be imposed upon with a base substitute.

This advice reaches further than patent medicines a great deal; it applies to boiler compounds, smoke consumers, exhaust heads, "separators," purifiers, and hosts of other things. But in all cases, it may be taken as a good general rule, that spurious articles, are not advertised much, if at all; and if a firm advertise extensively and continually their goods are bound to have some merit, or else they would not venture to spend much money in advertising. Deceitful business cannot be made to pay for long; fraud is like the crackling of thorns under a kettle—they blaze away brilliantly for a moment, but soon go out. And the advice is as aplicable to an engineer as any one; when you want any particular article, see that you get it.

Our friends of the N. A. S. E., in some parts of Illinois, were fooled to buy bogus engineers' licenses recently, it appears. Some fraud went round pretending to be an inspector of engineers appointed by the Governor of the State, and he also pretended to belong to the N. A. S. E., by which means he "walked into" the affections of his victims, securing their dollars in return for spurious licences.

The A. O. S. E. are protected against fraud of that kind. They are a secret society to the extent of being able to detect at once the deception of any one pretending to belong to the Order without really being a member. That is where the password comes useful. And many of them make it a rule not to buy anything not advertised in The American Engineer, unless they are themselves familiar with the merits of an article presented to them. They are thus provided with two strong safeguards against imposition.

FIELD'S MOTIVE POWER.

It is not often that journalists are able to announce a distinctly new departure in mechanical or engineering science. Such, however, is our pleasant duty on this occasion, *Invention* says, in connection with the name of a gentleman whose energies have for many years been devoted to the perfection of the steam boiler. Mr. Edward Field, C. E., whose boiler is well known to power users, has succeeded in deriving from mixed gases under pressure the same amount of work hitherto rendered by five to eight times the same quantity of pure steam. This volume of mixed gases consists of steam introduced into a large volume of heated air. The inventive portion of the design relates to the apparatus by means of which the discovery is utilized in practice. This apparatus consists of two portions—namely, the experimental, whereby Mr. Field demonstrates the principles of his discovery, and the practical, by which he illustrates the application

of those principles in doing work. It would perhaps be more correct to define the new departure as a discovery pure and simple.

The following is the discription given by the *Times* (London) of the experimental apparatus, which has been tested by three engineers—namely, Mr. Collett Homersham, C.E.; Mr. D. K. Clark, C. E.; and Mr. Perry F. Nursey, C. E., each of whose reports substantiates this economy and points to still higher results with a larger engine properly and efficiently fitted with the necessary adjuncts for working upon Mr. Field's principle:—

"The experimental apparatus consists of two measuring chambers of different capacities and a working cylinder having a weighted pistou. In order to prevent condensation or loss of heat a high temperature is maintained in each of the chambers. In order to render the experiments comparative, steam was first admitted to both of the measuring chambers at a presure of 60 lb. per square inch. This steam, which represented 20 volumes, was then admitted to the working cylinder, and it raised the piston with a load of 171 lb. to a height of 5½ in. The experiment was repeated, when the piston was only raised 4¾ in. The smaller of the two chambers was then half filled with steam at 60 lb. pressure, and the larger chamber with heated air at a temperature of 400 deg. Fahr., which is abont the temperatnre required in practice and at atmospheric pressure as shown by the respective gauges. The proportions were two of steam and 16 of heated air, and npon the admission of the steam to the air the gauges on both chambers instantly showed a pressure of 60 lb. per square inch. Upon the mixture of steam and air being admitted to the cylinder the weighted piston was rapidly driven np to 7½ in., which was as high as it could reach, and represented the stroke of the piston within the cylinder. Upon the experiment being repeated the weighted piston rose much more rapidly, giving the cylinder cover a violent blow. . . The principles here involved have been put in practice by Mr. Field in a portable engine, which, however, has several drawbacks in consequeuce of the mixing chambers having to be superadded to the existiug engine works. These chambers are mounted on the top of the engine cylinder, and there is a chamber for each end of the cylinder. Each of these chambers in turn receives its charge of heated air, into which is delivered a proportionate charge of steam. The mixture is delivered from each chamber alternately to the front and back end of the cylinder, causing the out-strokes and the instrokes of the piston in succession. Upon the occasion of our visit the engine was first run with steam alone and without a load. It was then run with combined steam and heated air in about the proportions previously stated. The conditions under which this run was made were the same as in the previous run, and the same observations were taken. It may be mentioned that the temperature in the air chamber should not be less than 400 deg. Fah. for the proper development of the advantages of the system. As a matter of fact the air temperature during the engine trial was not higher than 300 deg., but was generally much lower, owing to draughts and to the inefficient construction of the heating apparatus. On comparing the results of the two engine runs, made respectively with pure steam and with combined steam and heated air, it was fonnd that there was an absolute gain of 44 per cent. in favor of the Field system as against ordinary steam."

A Russian engineer in Baku has constructed a boring apparatus, the superior qualities of which, says *Iron*, are exciting great interest in the Caspian oil districts. It is worked by hydraulic power, the pressure being duly recorded on a manometer, and requires but one attendant. For exploiting the naphtha, an 18-inch boring is made; for trial work a 6-inch boring suffices. The 18-inch boring requires 6,000 poods of water per hour; the 6-inch only 1,000 poods, the water on leaving the apparatus being caught and re-used. This machine is capable of cutting through hard rock at the rate of 15 millimeters per minute. The stone borings, &c., are continually washed out of the hole by the outrushing water.

ELECTRICITY.

XI.—DYNAMOS.

The loadstone or "native magnet" is an ore of iron consisting mainly of the two oxides of that metal, together with a small portion of quartz and alumina. It is found plentifully in the iron mines of Norway and Sweden, and occasionally in the iron mines of other countries.

This natural magnet is imitated by magnetizing bars of iron. And magnetism, whether derived from a natural or artificial magnet, is closely allied to electricity; and some think that magnetism is only electricity under peculiar conditions.

There are various methods of magnetizing bars of iron. Turning the iron into the shape of a horse shoe has many advantages. But whatever way a magnet is made, and however an artificial one is magnetized, it acquires a north and south pole. And when placed in a free position, the south pole of a magnet will point towards the north pole of the earth. And if the north pole of one magnet be placed near the north pole of another, they will repel each other. On the other hand, a north and a south pole will attract each other.

When laid on one side, a magnet should be placed in such a position as it would acquire if suspended by its equator or center, that is with its south pole towards the north pole of the planet. That is its natural position. (Parenthetically we may remark in this connection, that when the south pole of the human body, which is the left side, is turned towards the north, a greater ease is attained than in any other position, because terrestial magnetism and the magnetism of the human system are then in harmony).

When the peculiar properties of the loadstone are imparted to a bar or mass of steel or iron by means of a galvanic or voltaic battery, the artificial magnet is called an "electro-magnet."

Many of the philosophical investigators of the last century had observed a close relationship between that condition of things called "electricity" and that other condition of things called "magnetism." In 1819 Hans Christian Oersted, of Copenhagen, proved (for the first time) that current electricity has magnetic properties. This was amplified by the researches of Ampere and Arago in France, and Sir Humphrey Davy in England. But the broad day light of electrical science dawned when Faraday discovered that electric currents could be produced by means of magnets.

Like electricity, magnetism has been explained by a theory of two fluids, "austral" and "boreal." Then two kinds of magnetism is a theory advocated by some to account for the north and south poles of the magnet. And, according to Ampere, magnetism is only a combination of electrical circuits. From that view magnetism may be called "compound electricity," or electricity in a compound state.

To construct a dynamo, or a machine to generate electricity, a mass of iron is used as a core, around which copper wire is wound or coiled. The magnet thus formed is excited by electricity, and the wire around it, which is insulated, by a covering of silk or some other insulating material, is magnetized as well as the iron core. The power of such magnet varies according to the strength of the exciting current and the number of coils of wire around it. And which end will be north pole depends on the way the wire is coiled round the core. And when a bundle of wires, tied together, is used as a core, instead of solid iron, it becomes more powerfully magnetized.

Care is necessary in winding the insulated wire round the core of the magnet, so that there be no overlapping, for much of its power would be lost if one coil overlapped another. After one complete layer of wire has been wound, another is wound over it, only in the reverse way, that is commencing where the first ended. Four or five layers may be wound around a magnet in that way. And a coating of sealing-wax varnish, or some other insulating paste, between each layer helps to secure perfect insulation.

Much depends upon the thickness of the wire. If high potential, or strong voltage, is necessary, then thin wire is used. Thicker wire is used when increased quantity (amperage) rather than voltage is required. Thus there is much difference in thickness between the wire of a dynamo used for operating arc lamps and that of an incandescent dynamo for supplying power. The greatest power is obtained when a certain amount of resistance is offered to the passage of the current, which is afforded by a thin wire, "so that the current becomes to a certain extent delayed."

The poles of an electro magnet are connected by a piece of soft iron, around which wire is wound, and called the armature, which completes the electric circuit. The armature revolves at a rapid rate and utilizes the current from the magnetic field (of which it forms a part), and its wire conveys the current to an apparatus called the commutator, which reverses the direction of the current, or turns alternating currents in the same direction, making them as one continuous current.

Another way to wind an artificial magnet is to use a bobbin instead of the core. And after all the layers of wire have been put on, the bobbin is taken out, and the iron or steel core may then be put in. This is the general way at the present day. We have stated the original way first and more fully, as the chief aim of these articles is to give those of our readers who are interested in electrical appliances an insight into the fundamental principles and development of electrical science.

The electrical industry in all its branches, is yet in its infancy, a very vigorous infancy it is true. Enormous sums of money are invested therein. And the number of those employed in electrical businesses of various kinds is very great. The probability is, as repeatedly stated in previous issues of THE AMERICAN ENGINEER, that stationary steam engines will soon become few and far between: electric motors will take their places; and power will be obtained, through the motors and conducting wires, from enormous central stations. Those who are now stationary engineers will have to become working electricians, or else, in the language of the profane poet, they will get left.

As Shakspeare says,

"There's a tide in the affairs of men,
Which taken at the flood,
Leads on to fortune."

The tide of electricity is rising high. The chapters we have published on the subject are merely short sketches of its beginnings—the book of Genesis, as it were, of the world's electricians, written from the standpoint of the ordinary steam engineer.

We are gratified with the expressions of "great interest" received from many readers. One says he has been "thunderstruck" by our chapter on Electricity in Steam Boilers. And several say we have been the means of giving them an appetite for studying electricity. That is just what we have aimed at, rather than attempting to furnish exhaustive treatises on the subject. Books on Electricity are numerous enough. And technical electrical publications are now so plentiful that the youngest of them (*Electricity*) has been constrained to break through the fence of electrical orthodoxy and profess work a little on the "popular" side.

FEED-WATER HEATING.

By W. H. Booth.*

There is a common impression about that a steam boiler is not an efficient machine. This idea has probably arisen from the fact that even a theoretically perfect steam engine can only realize a small portion of the heat which it receives. This recognized scientific fact has spread to the boiler in men's minds, whereas actually even an ordinary boiler does not reject much more than 30 per cent. of the available energy in the coal.

Apart from loss by radiation and blowing out, there is only one direction in which heat is rejected by the boiler other than the steam outlet, and this is the chimney. If we could ascertain exactly the temperature of the furnace and of the chimney, we should be able to state at once the proportion of heat lost.

If we wish to reduce the waste, we commonly add to the area of heat-absorbing surface of the boiler, and we have known boilers, constructed to utilize waste furnace gases, of as great a length as 60 feet, or even more. Such a length is wrong on at least two counts. In the first place it renders a boiler

*In the *American Machinist*.

liable to severe stresses, and ruptnre of the shell ring seams may be thereby cansed should the seating settle even a very trivial amonnt.

The second reason is different.

The water in a steam boiler has, or shonld have the temperature of the steam prodnced, and consequently it is absolntely impossible to rednce the smoke temperature to anything near that of the boiler, seeing that there must be some considerable difference to overcome the resistance of the boiler plates to the conveyance of the heat from the gases to the water. The difference of temperature is similar to the head or pressnre reqnired to cause water to flow throngh a pipe or along a channel. There can be no flow without *head*. A boiler at 350° F. can obviously never absorb heat from smoke at 350° F.

In practice we very soon arrive at that length of boiler beyond which it is not worth while to go for further economy.

English practice fixes the length at about four diameters for stationary work, and internally-fired boilers. American practice seems to tend even to a less ratio.

It is not disputed that a boiler of several hundred feet in length would absorb mnch more of the heat of the smoke than one of nsual length, but very soon it wonld be found that radiation from the top was in excess of the heat received below. As it is, the length of a boiler is made *less* than mere fuel economy would demand, for reasons of space and convenience as well as cost.

Let ns suppose a 60-foot boiler will steam at 300° F. Then, allowing a temperature head of 300°, the chimney temperatnre wonld be 600°. How could we rednce this latter temperature, and yet preserve our heating surface the same? By a very simple act. We conld cnt in two the long 60-foot boiler, and make two of 30 feet each, but while in the one containing the furnace, the steam, as before, would be at 300°, it wonld not do to keep the second half at so high a temperature. On the contrary, we wonld close every commnnication between the two halves. Into the second half we wonld pump cold water, and it wonld heat np there to perhaps 150°, and this we would pnmp into the boiler proper, and evoporate it there to steam at 300°.

We have now two vessels at 300° and 150° respectively, and, if we still allow 300° difference between boiler and chimney, we shall get a chimney heat now of only 450° instead of 600°. Here we shall have saved one-fourth of the waste heat, and if this was 30 per cent. the simple division of the boiler into two independent halves will have effected an economy of 7½ per cent. of fnel. This is the primary idea of a feed-water heater, viz., the cntting off of a portion of the heating surface of the hot boiler,and placing it under circumstances where it can better absorb low temperatnre heat.

The principle might be fnrther extended by dividing the 60-foot boiler into three sections, the first of such length that it would heat the cold feed water to 90° only, the second to heat it fnrther to 200°, and the third or boiler proper to evaporate it at 300°. In this way the chimney would not be over 390°. In practice the principle is only carried to the second stage, which is often snfficient to insure a chimney temperature of 400° only, or even less in some cases.

Apart from economy of fuel, a feed heater helps to preserve a boiler from injury which may be causcd by cold feed, and it is a great aid to steady steaming, also. There is one point about smoke temperatures and their reduction which has always been overlooked. Because no thoroughly practical means snggests itself to me for utilizing the fact, is no reason for not naming it. All bituminous coal contains, of conrse, hydrogen; when burned, this becomes water, or rather highly snperheated steam. Now, we all know that a ponnd of water at 212° contains only abont 213 units of heat, and that a pound of steam at 212° contains about 1,178 units of heat, or 966 units more than it wonld do if reduced another degree in temperature.

In 100 pounds of an ordinary bitnminous coal there will be perhaps 5 pounds of hydrogen, and when bnrned, these 5 ponnds become 45 pounds of water, and pass of at the chimney as steam, carrying with them all their heat of evaporation. Ordinarily each 100 ponnds of coal evaporates, say, 900 pounds of water. If the heat of evaporation of the 45 pounds of water in the smoke conld be taken ont of it, we shonld get an additional evaporation of 45 pounds from each 100 pounds of coal. This is an extra twentieth, or 5 per cent.

There is not much to be saved by reducing smoke temperatures below 500°. Each 100° reduction below say 600° corresponds to, say, the following, on the assumption that at 600° we waste a fourth of the heat.

To 500°=4%; to 400°=8%; to 300°=12%; but to 200° the additional saving is donble, for we shonld save not merely the visible or thermometric heat, but also the latent heat of evaporation, and the chimney would then send forth no steam, but only uncondensable gases, whilst the water would be drained off.

In a considerable experience of feed water heaters of the vertical pipe type, which consists of a series of rows of cast-iron pipes 9 or 10 feet long, and 4 inches diameter, set in a top and bottom box casting, and so arranged that the feed water passes up all the pipes as it may choose to travel and is not compelled to travel in any special direction, I have found one prominent causeof wearing out.

The cold feed enters every bottom box, and rises into every pipe of every box. As it ascends the pipes which are stood in the flue, it receives heat from the smoke, and frequently passes out of the top boxes and to the collecting main at 200° or 300° of temperature. Now, it almost invariably occurs that the lower ends of every pipe and the lower boxes are quickly rnsted away, whilst other parts are nntouched. The reason is simple and obvious. The pipes are so cold at their lower ends, where the cold feed enters, that they condense on their surfaces the steam from ont the smoke, and with this steam the acids arising from the snlphnr in the fuel and the iron thus moistened rapidly becomes crowded.

If proof were needed of this being the canse, it is furnished by the fact that, if about a sixth of the heated feed water be retnrned mixed with the cold feed throngh the feed heater, the corrosion is stopped, because the pipe is then not cool enongh on its surface to canse condensation of the steam gases in the smoke.

This return of part of the heated water means simply that to preserve the pipes from corrosion we have sacrificed abont a sixth of the economy secured by the feed heater. This is often 12 per cent, and thns we spend 2 per cent of our fnel to preserve a few pipes. In some steam plants I have in my mind, the amount so spent will figure ont 5 ponnds of coal per pipe per week, or, roughly, a ton in 10 years. In England, where a pipe costs from 3 to 6 tons of coal, according to locality and relative cost of fnel, it is clearly a commercial economy to save the pipe in this way, especially if the feed water be good, and free from scale producers, for then the life of a pipe may be almost said to be indefinitely long. Let us, however, snppose that, in place of sacrificing a sixth of our gained economy, we sacrifice a sixth of the pipes. At present a sixth of every pipe rots away and ruins the whole pipe. Snppose, instead of allowing each pipe to rot away one-sixth, we allow one pipe in six to rot away wholly. Then, to save each of this selected sixth of the pipes wonld demand, by the same figures, 6 tons of coal in 10 years per pipe, and in most cases this is of greater cost than the pipe, for when allowed to rust it sometimes takes 10 years to rnst away a pipe to the worn-out condition. It thns appears that, by concentrating the cause of damage npon a few pipes, we can make a trne commercial saving, and at the same time we can use the means thus employed as a further step towards economy, for we can isolate a sixth of the feed heater, and tnrn through it all the feed, so as to warm this above condensation point, and when so warmed the feed passes out the remaining five-sixths of the heater and meets hotter conditions, and does not condense moisture on the pipe surfaces.

Of course the first pipes in the isolated gronp come next the chimney, and the coldest water is next the coolest smoke. The arrangement is valuable as an economy of both fnel and pipes, but experience alone will decide whether it can be made a trne economy to rednce smoke temperature below 212° by so dividing down the boiler into sections of gradnated reduced temperatnres that the final section or two sections will absorb latent heat—condensing the smoke steam to liquid, and realizing the 5 per cent. which bitnminons fnel wonld give. The loss arising from wet fnel wonld thereby be recovered.

Shold it be found to pay—a question too closely connected with that of forced or fan dranght to call for attention here—it would appear best that what we may term the condensing pipes of a feed heater should be of some material less readily injured by coal smoke acids than is cast-iron.

Feed heaters are too little employed. Many men will pnt down an extra 350° boiler rather than add a 150° feed heater to their present plant. These men do not realize the advantage of counter currents.

If they did so they would perceive the folly of increasing heating surface, or rather heat-absorbing snrface, in place of adopting the principle of division.

If any one shonld feel disposed to experiment, let him remember that there is over donble as mnch heat available between smoke at 213° and smoke at 210° as there is in rednction from 600° to 213°. Probably, therefore, in any scheme of sectional feed heating the condensing part may reqnire to be of larger area than might at first appear.

It would not, however, require to be double the area of the previous sections as above, because the condensing pipes, being wet, wonld act far more efficiently as heat absorbers than hot, dry pipes, and the steam is, after all, only a small portion of all the furnace gases.

Some day, when dranght is prodnced by fans, we may see the idea carried ont, of saving the invisible or latent heat of smoke steam.

STEEL PIPES.

The nse of riveted steel pipes is superseding that of wrought iron pipes. It was fonnd in America that cast iron pipes imported from Great Britain were more expensive than wrought iron plates, hence these plates were made into water mains. In this country cast iron pipes still maintain their supremacy, partially because of the plentiful supply of metal and the access to fonndries; while in America the use of wrought iron plates has developed facilities for the mannfactnre of pipes of this description made of small plates. The Steel Pipe Company, of Kirkaldy, have done something towards showing the advantages possessed by steel over wrought iron pipes. It is stated by Mr. D. J. Rnssell Duncan, Assoc. M. Inst. C. E., that wrought iron or steel pipes can be prodnced at a less cost per unit of length than cast iron pipes. A pipe built of steel can be made at a less cost of labor than one of wrought iron, on account of the reduction in the number of plates and rivets, and, therefore, of canlking and punching. Being less liable to corrosion than pipes of wrought or cast iron, the dnrability of steel is insured. It is stated by one authority that the best precaution is to have the pipes galvanized, then coated with natnral asphaltum or with a composition of pitch, tar, petrolenm, linseed oil, and chalk. This solution is heated in a bath to a temperature of 250 deg., and the pipes immersed till they acquire the same temperature as the composition. The pipes shonld also be coated as they are laid in the trench. As regards strength, the steel pipe is mnch superior to glazed stoneware or cast iron, or about three and a half times stronger than the latter. Mr. Duncan says: "As steel is on an average 1.3 times stronger than wrought iron, it is clear that for pipes of equal strength of plate, and allowing that the riveted or welded seams are of eqnal strength on both, the thickness of mild steel need only be abont 0.77 of the thickness of wrought iron." This economy of material can be effected by using open-hearth mill steel of the highest possible tensile strength, and of having less riveting than usual in American practice by reducing the number of the plates. Varions methods of jointing pipes are shown by Mr. Duncan, who recommends the Schnlz joint and one invented by himself, in which the socket can be of rolled steel of greater thickness than the pipe.—*Building News.*

[We do not qnite follow onr contemporary as to steel pipes being "less liable to corrosion than those of iron." In the vicinity of the sea or of salt soil steel corrodes more qnickly than iron.—*Ed. Invention.*]

CORRESPONDENCE.

NEW DEPUTY SUPREME CHIEF ENGINEERS.

Syracuse, N. Y., Aug. 10, 1891.

To whom it may concern:

Be it known by these presents: That by virtue of the authority vested in me by the Supreme Council, American Order of Steam Engineers, I do hereby appoint the following brothers to be Deputy Supreme Chief Engineers for the districts of the state named, and they must be respected and obeyed accordingly. (Signed.)

Jefferson Young, Jr., Supreme Chief Eng.

Illinois, (North Dist.) Jas. Harrison, Chicago.

Illinois, (South Dist.) Barney Sowman, 605 Second South St., Belleville.

Geo. W. Neal Suspended.

To the Editor of The American Engineer:

Sir:—You are hereby requested to publish the fact that the Jefferson Young, Jr., Council, No. 14, N. Y., have suspended one of their members, namely Geo. W. Neal, for non-payment of an assessment after being notified twice.

Conrad West, Cor. Engr.

The Largest Pumps in the United States.

To the Editor of the American Engineer.

Sir:—I visited the water works of the city of Cleveland, O., a few days ago and saw the largest pumps in the United States. These pumps are a pair of compound duplex Knowles Co.'s make, 36″x72″ x24″, 5′ stroke delivering 750 gallons at each stroke, over 30,000,000 gallons per day. They work nicely, and are fine specimens of pumping engines. Some of our boys talk about big pumps; I would like them to see these, they would never mention what they had seen again. Next time I go there I will get full data of these pumps. Yours truly,

Looker On.

That Ball Game.

To the Editor of the American Engineer:

Sir:—How is it we see no report of that great ball game between Kensington No. 3 and Southwark No. 4, of Philadelphia. *

That should have been reported; it was a most wonderful game. Think of playing ball in a pouring rain, and then the score: Kensington, two innings, three runs; Southwark, one inning, seven runs.

Then think of Lightfoot, 1st base; Weidner, umpire—O! how he got roasted.

Hugh Gorman, 3rd base, asked what he would do if any one threw the ball at him.

Williams, at the bat—1, 2, 3, out. Moore, kicking all the game.

Then those two boys from Chester, they did splendid. Why don't the rest speak up. Let a full report of the game be published. We also want a full report of those sack races; every race won by Frank Mellor, that is, he claimed every one. Who was that long legged fellow who made four jumps and over the line, a regular kangaroo leap. Come boys, speak up, don't be so bashful.

If you don't, we will ask the ladies; and won't you hear a report. Yours, Mr. Editor,

Speak Easy.

Slide Valve and Corliss Engines.

To the Editor of the American Engineer:

Sir:—That recording engineer is a great fellow anyway. He goes off half-cocked, with his long list of figuring, trying to mix a poor slide valve fellow all up. Well he can't tangle us a bit, can he? Let you fellows who run slide valves speak up.

Now, who the duce told him I had 1″ clearance on my old slide valve? I guess not. Don't run that way; get as close to head as possible. No good man who understands a slide valve engine would take an inch. How would a paste board thickness do? So now you see I do away with that ton of coal he speaks of per week. Made one ton, and as I save several other tons I am a big man in our place.

Now, recording engineer, you ask for a card. I have called on you for a card of this great Corliss you speak of. Don't run all over Philadelphia and find the best but drop down into any shop and take the first card you can get, and forward it to this paper, then I will publish a slide valve card that will knock you silly; hear me?

Yes I am sure that 60 M. E. P. is economical. *I can prove it*! Don't want any more turns.

Yes, we get all the work claimed, and it don't require a genius either. Well, old recorder, we will shake *some time*.

Yes, you are right, some are building Corliss that did formerly build the slide valve. New fad, that is all, and you know we must be in the fashion or die.

The Corliss is the dude engine. But for a genuine, every-day, hard-working, steady old reliable, give me my

Old Slide Valve.

* It was reported, in our last issue, by two who were present.

How To Organize a D. F. Auxiliary?

To the Editor of the American Engineer:

Sir:—Can you please inform me how to organize a Daughters of Fulton auxiliary?

I feel that our husbands and brothers (and neighbors' husbands) would really appreciate such an undertaking; but we lack information as to how to go about it, and what there is in it—not financially, but by way of edification.

Engineers' wives who are mothers have no doubt felt the sharp pangs of pain at being left alone one or two evenings each week to care for the little ones (in the evening) as we have faithfully done all day, awaiting the return of our all. And it is not very pleasant to hear him say impatiently (when he returns from work), "Well, is supper ready? I have to go to the engineers' meeting to-night." I have often felt that the supper (on those occasions) would be much more relishable if each of us (man and wife) had a meeting to go to, for a friendly social chat, so as to drop for a few moments the cares and perplexities of the day.

I, for one, also feel it a duty to assist my husband in attaining all possible knowledge of his business as an engineer. And I am sure there is no husband so selfishly dead to his wife's interests that he would object to her having all virtuous recreation that her constitution demands, and would rejoice in her endeavors to lessen the wear and tear of life's friction, thereby reducing the number of her grey hairs and retaining the roses on her checks.

Oh, mothers! time is flying with us; so let us make the best possible use of it, coming close together, setting our home engines aright, and keeping up the fire of cheerfulness, so that when those tired husbands of ours come home they may not find a single jar in its machinery. And let us watch well the balance wheel of patience with our little ones.

Mrs. Frank Purman.

Omaha, Neb.

19TH CENTURY ENGINEERS.

The above are men of thought, education and skill, acquired by practice, reading, and seeking information on matters pertaining to their vocation. Their engine room surroundings are suggestive of the ability they have; a look into their cupboards will reveal papers, books, periodicals, and circulars of new machinery and appliances, they are interested in, for by past experience they have found out that many of the modern devices are labor and money saving machines; they may not be well versed in all the details of such; they can explain the workings and functions and can readily see the merits of useful devices.

Nature may have been bountiful in its gifts of late to those men, but cultivation has much to do with their success.

There is no reason why machines should be behind the times; this is an age when literature upon every thing is very exhaustive in all details; and he would be a very curious business person who can not find works upon the subject he is interested in treating everything in detail.

These men take advantage of such matters; they read and digest it, and you will find them making progress. They are ever ready to impart their knowledge to those less fortunate, in being able to purchase, or perchance to retain mentally. These are our engineers of the 19th Century.

To-day there are some who do not seem to care if they could make advancements in life, by reading or associating themselves with persons of ability or experience. They are willing to trudge along in life, as their grandfathers did, without any hope of success. They do not descry the value of books or papers, they simply have no taste, they are as nature made them. To hear a person say he would not be bothered reading such stuff, that they had no use for them, would naturally leave a certain amount of suspicion that ignorance predominated with them, and that they were simply living by presumption.

Such a one I met recently, and upon the subject of reading, he declared most emphatically that he did not, or would not, read any of the so-called mechanical papers and books, that they were simply bosh; and would not spend even a nickle on any or all of them. He wished to convey the idea that he was a walking encyclopedian upon any thing pertaining to engines and boilers. Reason was useless; notwithstanding his radical aversion to education, he looks forward for success. It will never be through his knowledge of steam engineering. It may be through certain requirements he has that are indispensable to his particular "line of business."

Another "Case"—"An Engineer." This one in Michigan. Just think of it. When asked if he belonged to any educational organization, he replied, that he could see no good or any advantage in it; that it was only spending money and fooling away time—thinking probably his time was of some value in another direction. I made some enquiries, the results of same were that most of it was devoted to raising dogs; he not only objected to reading mechanical literature, but a newspaper of any kind had never been in his house—daily, monthly or yearly. He had never been guilty of it.

Another "Expert" was called upon the witness stand to testify in a case of a boiler being burnt, through building fire. When asked what caused the ridge or lumps on top of shell, (this being a portable boiler) he replied that it was made that way, hammered out so that the engine would fit itself to the boiler.

These latter "cases" are not 19th century engineers, simply beings, living in this year 1891.

Stephen Christie.

AMERICAN ENGINEERS' HOME.

The Supreme Council A. O. of S. E. at its last session took up the suggestion of Mr. A. B. Jenkins of Jenkins Bros., New York, that our Order should build a home for aged and disabled engineers.

The Trustees of the Supreme Council were given full power to select location, raise funds, and carry on this good work.

I have been requested by the president of the board (Bro. Bernard Born of Boston) to make an appeal to the manufacturers of steam appliances, steam users, and engineers of this country for contribution for the building of and support of the home. All contributions should be sent to Bro. A. W. Southwell, Treasurer Board of Trustees A. O. of S. E., care of American House, Cleveland, Ohio.

Let the contributions be liberal and flow lively.

Members of the A. O. of S. E. are (should they become aged or disabled) eligible to this home if in good standing.

Engineers not members of our Order become entitled to admission to the home by the payment of small yearly dues to the trustees.

Engineers who are not members of our Order and who have failed to pay the yearly dues can purchase an admission to the home for the rest of his days by payment of a small sum to be set hereafter.

It can be seen by the above that we want to make this home free as possible to all engineers, whether members of our Order or not. All contributions will be acknowledged in the columns of this paper. Let the good work be done quickly.

Who will start the ball rolling? I remain

Yours fraternally,

Jefferson Young, Jr., S. C. E

SECOND CHAT WITH A CHIEF ENGINEER.

I see an article in the *Review* of July 30, headed "Value of Independent Condensers," giving as printed below, a statement of comparisons of two boats, the E. P. Wilbur with an ordinary air pump and condenser, and the Saranac with an independent condenser:

Steamer Saranac, trip of August 8, 1890.	Independent air pump.
Miles run	1,830.
Coal used, tons	197.
Total revolutions	645,831.
Coal per revolution, lbs	.61

Steamer E. P. Wilbur, trip of May 11, 1890.	Connected air pump.
Miles run	1,830.
Coal used, tons	250.
Total revolutions	677,080.
Coal per revolution, lbs	.74

Now let us look into this matter by facts well known to engineers and make some inquiry. From indicator cards taken off an enging, duplicate of the E. P. Wilbur's, developing 1,500 horse power, it took 20 horse power to drive the air pump. Cards taken from other builds of engines indicate that it takes about .015 per cent. of the power of a compound engine to drive the air pump. We will approximate the power of the boats in question at 1,500 horse power and that required to drive the air pump at 22.5 horse power. At 72 revolutions per minute, the Saranac ran 149 hours and 29 minutes while the Wilbur ran 156 hours 44 minutes. Allow two and a half pounds of coal per horse power per hour consumed. This is a liberal allowance, as the builders on trials have developed a horse power on ess than two pounds. In the 156 hours the connected air pump on the Wilbur would take 8,875 pounds of coal. The independent air pump on the Saranac is driven by the most expensive engine yet devised to develop power, and cannot possibly develop on indicated horse power on less than seven pounds of coal per hour. Allowing this, the independent condenser pump would use developing 22.5 horse power in 149 hours, 23,467 pounds of coal. In either case the amount of coal would be insignificant in the aggregate, but I have called attention to a loss and given the cause of it.

Now let us compare the temperature of the hot wells as attained in practical workings. It is no unusual thing with a connected air pump and condenser to have the temperature of feed water to boiler from hot well 130 to 150 degrees, while that of the independent condenser runs from 90 to 110 degrees. The builders of the independent condensers satisfied a demand for an air pump that was free as possible from breakage, a serious fault with the attached air pump when the main engines are turned up from 90 to 100 revolutions. The builders of the main engines came to the rescue of the much praised independent condenser by putting in a heater to take care of this frigid feed water. Of course I understand that there is an advantage in vacuum when the temperature at condensation is 90 degrees, the difference between that temperature and 130 degrees resulting in three inches or more vacuum. Such comparison as that published, however, proves nothing. The data is insufficient and nothing computable is shown by it. The figures I have furnished are computable and they make a charge against the independent condenser. Let the latter make a counter charge with proper data. If the comparative statement of the performance of the Wilbur and Saranac proves anything for the independent condenser, the following proves twice as much against it, for the comparison is made on the same boat and engines. The steamer Inter Ocean, built in Detroit in 1872 and now in commission, came out with an independent air pump and condenser, and the usual frigid feed water was the result. The builders of the main engines in this case did not come to the rescue of the independent condenser with a heater, and she burned, towing the barge Argonaut from Buffalo to Chicago and return, from 220 to 260 tons per trip. I think she was run four seasons this way and then the independent air pump and condenser was taken out and the air pump was connected to the main engines with no further changes to engines or wheels. The result was that she towed the Argonaut the first five trips between Chicago and Buffalo and return on a consumption of 147½ tons of fuel per trip.

A well designed air pump connected with the main engines ought to run one season with little or no attention, save oiling. I mean by a well designed air pump, one with a large diameter and short stroke to decrease the velocity of bucket so it could pump solid water and not endanger its breaking. As between a well designed connected air pump and the independent condenser there is no question of choice in my mind, and nothing but figures and cards will convince me. I have not charged the independent air pump with the maintenance of two steam cylinders, oil and repairs, but let this go for the good of the trade.—E. N. Gineer, in the *Marine Review*.

THE TINPLATE TRADE.

The tinplate business is a subject of lively interest just now, on both sides of the Atlantic. The tin industry is going to be developed in the United States forthwith, without any doubt. And it is almost equally certain that thousands of Welsh experts in the manufacture of tin will "come over and help us." In the meantime it is very interesting to notice how the situation is viewed across the water. And here is what the *Ironmonger* (London) says:—

The period during which the tinplate works in South Wales and Monmouthshire have been stopped is now at an end, and the mills are being restarted throughout the districts in question. In some instances work will not be resumed for some weeks to come, but in the majority of cases the mills will be in operation next week. Whether the organized month of inactivity has achieved its purpose is a question which can be best answered by those actually concerned, but so far as can be observed by impartial outsiders its effects have been practically colorless. The stoppage was designed, it was stated by the makers, in order to prevent the prices of tinplates from falling below the cost of production. As soon as the works are again in operation it will be seen whether this aim has or has not been accomplished. Up to now the variations in quotations have not been other than normal, either here or in the United States. In London and at Liverpool the leading sorts and sizes are nominally but little lower than they were a month ago, whilst in the United States the quotations are but fractionally easier than they were when the new tariff came into force. On the whole this state of things is very much what might have been expected under all the circumstances. Dealers in America are fully stocked up, and importers there are alleged to have on hand tinplates equal to nearly or quite a year's consumption. They are, consequently, deeply interested in the maintenance of prices, and it may be taken for granted that there will be no "slump" in quotations if it can possibly be avoided. Yet it is obvious that an awkward condition of affairs may be brought about before long if the Welsh makers and their financial supporters deem it necessary to recommence production on a large scale. If the plates are made they will have to be sold without much delay, and, as the United States market is the largest consumer, efforts may be made to push sales there through usual or unusual channels at prices which will allow for the McKinley duty, and be below the figures for which the American vendors of the stocks now on hand are holding out. We do not assert that this will be the case, simply because the issue is not raised, but we think it is very probable. The American tinplate interests are evidently of the same opinion, and in furtherance of that view are said to have procured the abolition of the drawback hitherto allowed upon canned goods, &c., in the production of which imported tinplates have been used. If that is really the case then the Americans have done a clever stroke of business for their infant industry, but we take leave to doubt the possibility of a Treasury decision on the point overriding the specific provisions of the legislative enactment. As regards American progress generally in relation to their tinplate industry, it has to be noted that they are making preparations in an active manner for going on with the production. Amongst other matters they are alleged to have procured the setting aside of the Clause of the Contract Labor Law which forbids the bringing into the country workmen under contracts in favor of skilled tinplate workmen—thereby hoping to get over one of their most serious difficulties, but (as is now alleged) thereby giving deep offence to the workmen's organizations of the United States. Another difficulty of moment which the American makers will find hard to surmount is that of private brands. We on this side know what has been done, and is done, in respect of these brands. The difficulty is even more serious in the States, because vendors and importers in that country have been accustomed to have their own brands, and have built up their business with them. It is not likely, therefore, that these firms will quietly give up their special lines, and it is certain that if the American makers (when they are able to do the business on a commercial scale) will not supply the plates under the private brands, the owners of the brands will obtain their supplies from Wales just as they have done hitherto. As the developments proceed on the other side of the Atlantic we shall doubtless hear of many other points of interest. On this side, also, we should be pleased to learn that the Welsh manufacturers are planning to meet their energetic rivals of the near future in an equally energetic and progressive manner.

THE CHICAGO POOR HOUSE BOILERS.

At the last meeting of the Public Service Committee of the County Board, Cook County, Ill., they recommended that the contract for four poor house boilers be awarded to the Porter Boiler Manufacturing Company at $5,000. The County Board afterward recommitted the whole business.

The special committee reported that the Porter Company and John Mohr & Sons were the only bidders complying with the specifications requiring hydrostatic riveting, and recommended that all the bids be rejected so as to admit hand riveting.

Mr. Green said that disinterested persons had been consulted and no one could be found who preferred one kind of riveting to the other. Boiler Inspector Pickham disliked the hydraulic process, especially. Besides, under the present requirements, but two or three firms in Chicago can compete, which is unfair.

Mr. Struckman insisted on awarding the contract according to the specifications, but General Lieb was opposed to it, saying it looked suspicious to make the specifications so exclusive, and his motion prevailed.

THE LARGEST DYNAMO.

The largest dynamo, so far as output is concerned ever constructed in this country has been designed by Mr. T. L. Wilson, and is intended for metallurgical work, its special office being the electrolytic reduction of aluminium. The peculiar features of its design that at once command attention, are the absence of any separate commutator, and the unusual construction of the armature. This is built up of very massive bars of drawn copper, insulated with mica and asbestos. The brushes rest directly on the surface of the armature, between the pole pieces. The frame of the machine consists of two enormous castings with salient pole pieces, having wrought-iron cores both above and below the armature. The armature itself is twenty-four inches in diameter and forty-seven inches long, and is of the Gramme construction, formed upon a five-inch hammered steel shaft resting in composition bearings 15 inches long. The armature alone without the pulley weighs 6,163 pounds, while the frame contains 11,000 pounds of castings and 7,000 pounds of solid forgings. As the machine stands with its present pulley it weighs a little less than 30,000 pounds. The output is intended to be, if necessary, as high as 750,000 watts, and normally perhaps half that figure. The electromotive force actually employed will probably not be over 50 volts, though the machine is capable of giving 110 at a reasonable speed. The designer of this dynamo, Mr. T. L. Wilson, has as yet given it only a partial test, but enough to show that the requisite electromotive force can be readily developed, and that the machine losses are not likely to be severe.—*Ex.*

Hine & Robertson, of 45 Cortlandt Street, New York, have been appointed sales agents for the Reliance water alarm columns; also for the Wainwright water tube heater.

ANOTHER MISERABLE STRIKE ENDED.

A dispatch from Omaha, Neb., last Monday, says:

The Omaha smelter strikers divided to-day and the fight assumed a curious phase. Already some men are at work at old prices, while the remainder hold ont for eight honrs with ten hours' pay. The men began assembling as early as 6 o'clock, and an honr later there were fully 400 of them in front of the gates. Many of them had their dinner pails and nearly all woie their working clothes. Some expected a conference and hoped for a settlement, while scores openly voiced their sentiments to the effect that enongh conferences had been held and that they were going back to work, whether their comrades wanted to go back or not. That they meant what they said was clearly demonstrated when the passage-way through the time-keeper's office was opened and it was announced that all men who wanted to go to work could do so. Despite the efforts of some men to stop them, those who were heartily sick of the strike availed themselves of the opportunity and passed inside. They went directly to their old places, and were set to work cleaning up and getting ready to start the fires. Shortly after 8 o'clock there were fully two hundred men at work and smoke was beginning to roll from the chimneys when Mr. Barton drove up to the office. On one side several alleged leaders harangued the men, demanding that they hold out, while a little farther removed a priest advised the men to go to work and settle the price later. In the foundry and machine shops the full force of men was pnt to work and the yardmen and roustabonts were there in force. Several men were cleaning out the tanks in the blue shops and the fires were roaring in the "cupells" in the side shops. A score of men were busy in the great refinery building and in the Cnpolas the ring of the sledge and bar bespoke the efforts that were being made to clean out the huge blast furnaces. These furnaces were almost empty when the men went out, else it wonld have reqnired weeks of work to have again put them in readiness to start the fires. They were run so low that another hour's work would have emptied them, hence it will be a comparatively easy matter to clean out the "frozen" mass that was left in them. It is the intention to start up the first blast furnace to-morrow night, and one will probably be started on each shaft thereafter until the whole ten are running. Early this afternoon handbills were scattered broadcast throughout the city calling a mass meeting under the Douglas street bridge at 4:30 o'clock this afternoon. The circular was headed "Barton's Treachery," and called upon "all friends of justice, honor, and fair play" to attend and take part in the meeting. The dissatisfied strikers met and were harangued by leaders. Two of those present who dared favor returning to work were assaulted. The police patrol put down the fight before it became general.

LUCKIEST SHIP AFLOAT.

There is a vessel now lying at Mission No. 2, San Francisco, that attracts a great deal of attention by her queer rig and old-fashioned appearance. She is the British four-masted bark Omeo, belonging to Melbonrne. The old craft has quite a history and was formerly a steamer. She was built in 1858 in England and is 789 tons. During the civil war she was used as a blockade runner and made a number of trips to Charleston, S. C., escaping capture more than once from the federal war vessels.

The last trip she made was a remarkable one. She passed the gun-boats that were blockading the harbor, and then orders were given by the flagship to keep a sharp lookout for her when she attempted to leave and to catch her at all hazards. The days went by nntil six weeks had passed, and the officers were beginning to think that the steamer had given them the slip and made away without their knowing it, when one night rockets were seen from the cruisers as if some one was signaling on shore.

A bright lookout was kept for the slippery blockade-runner, and just before daylight she was seen well in shore, passing out. She was loaded to the gnards with cotton, and had several hundred bales piled on deck. Half a dozen steamers started after her at once, and it seemed as if she would be caught at last. But she managed to reach open water without coming in range of the guns of the warships, and in a few hours had distanced all but one of her pursuers.

This was one of the new gunboats, a screw steamer of great speed; and as the two flew through the water the American captain had the satisfaction of noting that slowly but surely he was overhauling the heavily-laden blockader. The captain of the British steamer also perceived that the gunboat was gaining on him, and he knew that it was only a question of time, unless something turned up to prevent it, when the American would be on his way to New York with the cotton steamer in tow.

He looked at his deckload, which was worth thousands of dollars in Liverpool could he land it there, and then looked at the American, which was slowly crawling up on him, until every minute he expected to see the puff of smoke from her bow gun. He decided that the deckload must go. But there was great danger of crippling his steamer should he drop the big bales over the side, as one of them might be caught in the propeller and then ship and cargo would go to New York without a doubt.

In order to prevent this a long stage was rigged over the stern and the bales rolled out on it before they were dropped into the sea. The plan worked first-class—in fact, better than the bold Englishman had dared to hope. Bale after bale was dropped overboard, and soon a long line of them floated on the water right in the road of the American steamer and no attention was paid to them by the officers of the gnnboat until a crash was heard and in a few seconds her engines stopped. The captain went down into the engine-room to learn what was the matter, and a short investigation showed that the gunboat was helplessly crippled.

One of the bales had been caught by the propeller and its contents wound around the shaft in a second, and to their chagrin the rich prize slipped through their fingers when they were nearly alongside. After the war the Omeo went to Australia and for a number of years ran from Melbourne to New Zeland, and was then turned into a sailing vessel. She is regarded as the luckiest ship afloat, as well as one of the fastest, as, in spite of her queer rig, very few can outsail her.

CHILDREN'S DAY AT THE ILLS. STATE FAIR.

The State Board of Agriculture have fixed upon Tuesday, September 29th, as Children's Day. Superintendents of schools are respectively requested to notify the Secretary of the number of children on the rolls of the public, private and parochial schools of their respective districts, under the age of fifteen years, that a sufficient number of complimentary tickets may be sent to each school to put a ticket into the hands of each scholar, whether they contemplate attending the fair or not. At Chicago, in 1885, 30,000 school children attended the fair on Children's Day, and it is hoped that more than that number will find their way into the fair grounds at Peoria this year. Teachers accompanying their schools will be provided with a complimentary admission ticket. For further information address W. C. Garrard, Secretary, Springfield, Ill.

OVERHEATED BOILER STARTS A BLAZE.

On Friday of last week, a party of some 1,300 excursionists from New York City, on their way to Bridgeport, Conn., by the steamer Elm City, were panic stricken when about midway between the two cities. About 7 o'clock in the evening fire broke out over the boiler room, near the port paddle-wheel, and blazed up in a manner that frightened the numerous passengers out of their wits almost. The smoke was also so voluminous and dense that all feared matters were worse than they really were. To say that there was intense excitement is putting it very mildly. The passengers were simply terrified, and for some minutes panic stricken. Children clung to their mothers for dear life, and the women screamed in the greatest fright. A man and woman in a state room directly over the boiler were almost suffocated by the smoke which filled the room, and were carried below in an unconscious condition.

The prompt work of the officers of the boat was the only thing that averted an awful catastrophe. The crew were set at work with axes chopping away the woodwork in order to get at the blaze. An aperture was cut in the floor of the state room over the boiler, a hose inserted, and a stream of water was soon playing on the flames. After working about an hour the men managed to extinguish the fire.

The blaze originated from an overheated boiler which ignited the woodwork in the engine room. The man and woman who were overcome by the smoke recovered before the boat reached New Haven. A few of the women fainted during the fire, but no one was seriously injured.

MINE MACHINERY BURNED.

As an illustration of how strikers become demons, a dispatch from Terre Haute, Ind., of August 15, says:

Fire almost completely destroyed the machinery of the New Pittsburgh Coal and Coke Company at Alum Cave, Sullivan County. There has been a strike at the mine for a week past, and it is thought the mine was set on fire after midnight this morning. The mine was worked by machinery which was of the costliest kind and the most complete of any in the State for handling coal and burning coke. The company estimates the loss at $100,000 two-thirds insurance. It will be impossible to resume work inside of several months.

ANOTHER IMPROVED INDICATOR.

We notice in one of our American exchanges illustrations and a lengthy description of a new steam engine indicator called the Straight "Lyne" indicator, being presumably so named after the inventor, Mr. Lewis F. Lyne. The paper carrying drum and spring and leading pulley, as well as the steam cylinder, piston and spring, are substantially the same as those of the Thompson instrument. We may assume, therefore, says the *Mechanical World* (Eng.), that the means employed to give a straight line movement to the pencil is the chief feature of the new indicator. The pencil lever is carried at the inner end by a vibrating back link, and the piston rod is connected to the pencil lever by a short connecting link as in almost all modern instruments. A projection on the outer end of the pencil lever slides in a narrow slot in a fixed vertical plate, and in this way the pencil is caused to describe a straight line. If the lengths of the connecting and back links are correctly proportioned, it is evident that the movement of the pencil will be accurately proportional to that of the piston. The idea is ingenious enough, but it is not by any means new. An indicator with a precisely similar pencil movement was placed upon the market some eight years ago by Messrs. Casartelli, of Manchester, but the friction of the pencil piece in the vertical slot proved a very serious disadvantage, and the instrument was eventually abandoned for this reason. We opine that Mr. Lyne will experience a similar difficulty, since, owing to the relatively extensive movement of the pencil, any frictional resistance to its motion cannot fail to seriously affect the freedom of movement which is so essential to ensure accuracy.

"Where are you going, my pretty maid?"
"Going to cooking-school, sir," she said.
"Can I go with you, my pretty maid?"
"We don't cook veal today," she said.
—*New York Herald.*

A LEGAL RIDE WITHOUT A TICKET.

It has remained for the learned and erudite justices of the supreme court of New York to so interpret the law and facts as to produce the judicial pronunciamento that a man may ride without a ticket and without paying fare upon a passenger train of a railroad company. A gentleman of the name of Hardy, resident at Haverstraw, desired, it seems, to go to New York on a matter of business, and sought to purchase at his station a return ticket at the regular schedule price. The office was closed, and he boarded the train without a ticket. He then gave the conductor a dollar and told him he wanted return transportation then and there. Not being provided with a portable ticket office, the best the conductor could do was to purchase a return ticket for Mr. Hardy from Congers, the next station, which he did, and which Mr. Hardy accepted. Upon returning home at night Mr. Hardy was informed by the gateman that the train then leiving did not stop at Congers, and thereupon the circumstances were explained to the conductor of the outgoing train, who, accepting the explanation, told him to get on the train for Haverstraw. The trouble arose when the conductor attempted to collect fare from Congers to Haverstraw, which was not covered by his ticket. To this Mr. Hardy demurred, on the ground that he was entitled to be carried from Haverstraw to New York and return for one dollar, which dollar he had duly paid. The court decided that, having paid to an agent of the company the regular rate, he was entitled to full service, and a judgment for damages for ejecting him was promptly sustained.

The lesson to be learned from this experience of Mr. Hardy is, that when a person desiring to travel on a railroad cannot, by the fault of the company or its agents, procure a ticket before boarding the train, he is entitled to the same service at the same rate, upon tender of the amount of the rate, to the conductor, although the rate is special and the service excursion. If a dollar is the advertised rate from Haverstraw to New York, then upon the payment of a dollar to the first agent of the company with whom the passengers comes in contact, whose employment is such that he has a right to demand payment, he is entitled to be carried from Haverstraw to New York.

In this case another principle of importance is involved. The conductor had actual notice of the facts involved, and upon a full, fair statement by the passenger, and a statement that he claimed the right to ride to Haverstraw on his ticket reading to Congers only, he told him to get aboard. By that act he led the passenger to believe that the ticket would be honored in accordance with his claim. If the conductor had any objections to make, that was the time to make them. After leading the passenger to believe that no objection would be raised, and thus inducing him to board the train, the conductor will not then be permitted to raise objections founded on facts which were in his possession before the passenger entered the train.—*Railway Review.*

LIMITS OF STEAM EXPANSION.

The following extract from a circular issued by the English builders of a high-speed engine said to run satisfactorily at 700 revolutions per minute and to develop 200 horse-power, is interesting, says *Mining and Scientific Press*, since it attempts to confine the use of double and triple expansion to certain limits: If the boiler pressure always exceeds 70 pounds, it is worth while to use a compound engine; if as high as 150 pounds, a triple-expansion engine. If the engine exhausts into a vacuum, the corresponding pressure will be about one-fourth lower. The extent to which the steam may be expanded with advantage depends upon the boiler pressure. If the expansion is carried to more than a certain number of volumes, it is advantageous to divide it into two stages, *i. e.* to expand partly in a high pressure or small cylinder or cylinders and partly in a low-pressure or large cylinder or cylinders. With still greater expansion, it is worth while to expand in three stages, *i. e.*, in three successive cylinders of increasing diameter, and so on.

HE KISSED HER.

I kissed her. Yes, I will admit it,
We two were alone in the hall.
Her roses were red, and the perfume
Got into my head, that was all.

By Jove, but it wasn't my fault, man—
'Twas her own—she was ravishing fair;
Her lips were like rose-leaves uncurling,
And her eyes were like stars, and her hair

Was as sweet as the breath of wild violets;
Lord love you, how could I resist!
A man's only human whatever,
And that woman was made to be kissed.

—B. of L. E. *Journal.*

LITERARY.

The Technical Society of the Pacific Coast have issued their "Transactions" for the past half year, containing interesting and edifying papers on Street Paving in San Francisco (by S. H. Smith), Hall's Hydro-Steam Elevator, with diagrams, (by R. Hinchliffe); Abrasive Processes in the Mechanical Arts and the Poole System of Grinding Calender Rolls, with diagrams, (both by John Richards); also papers on the Nicaragua Canal, with map, (by H. C. Taylor, U. S. N.), and the Physical and Geological Traces of Permanent Cyclone Belts, with diagrams, by Marsden Manson.

The Cosmopolitan is in the front rank of illustrated monthlies. In reading any chapter of No. 4 of Vol. XI, (August number) the current of interest flows with a high potential. "Gambling in High Life," by Gen. Adam Badeau, is so captivating that one can hardly stop for anything, after starting reading it until the end is reached. Then Prince Bismarck, by Murat Halstead, beats everything in current literature. There is a suspicion that Emperor William is gone extremely daft, and certainly he made an insane move (when he was most in his senses) by forcing Prince Bismarck into retirement. And as there is a strong undercurrent of expectation that the grand old Bismarck will soon "return to power," Mr. Halstead's illustrated article on the Iron Chancellor is doubly interesting.

The Compass is a new literary venture. "We issue this," they say, "the first number of a new serial, venturing to believe that it will be found to fill a want. It will be our endeavor to give such information respecting the construction of mathematical and surveying instruments, with the best modes of using them, new and improved methods of procedure, etc., as may both interest the engineer, surveyor, draughtsman or student, and be of practical value to him in the pursuance of his profession. The theories and principles relating to the above will also be examined, whilst new inventions in the same and kindred branches, whether domestic or foreign, will receive that attention to which their merits may entitle them.

TRADE NEWS.

The Metropolitan Street Railway Co., of Macon, Ga., have recently ordered from the Ball Engine Co., of Erie, Pa., a complete plant consisting of 150 h.p. tandem compound engine, boiler, heater, pump, etc. They are going to have a very complete plant Then Dravo & Black, the Pittsburg representatives of the Ball Engine Co., have sold the Braddock Street Railway Co., of Braddock, Pa., a 100 h.p. Ball engine, also a boiler, heater, pump, etc. They have also sold the Pittsburg Plate Glass Co., two 150 h.p. Ball engines.

The Pelton Water Wheel Co. have opened an "Atlantic Department," at 235 Central Building, Liberty and West streets, New York City. The opening of this New York office enables them to make deliveries from this point, of water wheels and motors, together with water pipe, shafting, pulleys, and such other machinery as is connected with the development of power by the Pelton system.

The advantage this location affords for favorable freight rates, as well as rapid and frequent communication with all parts of the world, are too apparent to mention.

The Phosphor Bronze Smelting Co., Limited, whose head office is at 512 Arch St., Philadelphia, have issued a revised price list No. 8, which contains useful tables showing approximate weights of phosphor bronze wire and plates, according to the various wire gauges, together with a table showing the difference between the well-known wire gauges.

Map of the United States.

A large, handsome map of the United States, mounted and suitable for office or home use, is issued by the Burlington route. Copies will be mailed to any address on receipt of 12 cents in postage by P. S. Eustis, Gen'l Pass. Agent, C., B. & Q. R. R., Chicago, Ill.

CONTRACTS OPEN.

Water-Works.—Sealed proposals will be received by the Chairman of the Water Supply Committee to build a system of water-works for this place, Gainesville, Fla., according to plans and specification on file. Bids will be received and opened on September 1, 1891. The committee reserves the right to reject any or all bids. For copies of plans and specifications and any further information address

A. J. McArthur, Chairman Water Supply Committee.

Steam Heating.—Sealed proposals addressed to A. P. Wooldridge, Secretary of Board of Regents of the University of Texas, will be received until 12 o'clock, noon, August 22, 1891, at Austin, Texas, for the erection of a steam heating plant for the university. Plans and specifications can be seen at office of Burt McDonald, at Austin, Tex., or they will be sent to bidders upon a deposit of $5, guaranteeing their return. Right is reserved to reject any or all bids and a certified check for $300 must accompany each bid.

Burt McDonald, Architect.

Sewer.—Sealed proposals will be received by the Common Council of the City of Terre Haute, Ind., Tuesday evening, September 1, 1891, for the construction of about 4,630 feet of brick sewer, varying in size from 2ft. 4in. by 3ft. 6in. to 3ft. 4in. by 5ft., and about 6,000 feet of pipe sewer, varying in size from 12 inches to 24 inches in diameter.

56 catch-basins, 16 manholes, 11 lamp holes and outfall at river.

Certified check for $2,000 to accompany bids.

Council reserves right to reject any or all bids.

Plans and specifications on file in my office.

Frank H. Cooper.

U. S. Court House, Etc., at Denver.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock p. m., on the 8th day of September, 1891, for all the labor and materials required for the joinery work, wood flooring, marble work, vault doors, cement floors, etc., for the U. S. Court House and Post Office, etc., building at Denver, Col., in accordance with the drawings and specifications, copies of which may be had on application at this office or the office of the Superintendent at Denver, Col. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Each proposal must be inclosed in an envelope, sealed and marked, "Proposals for the Joinery Work, Marble Work, etc., for the U. S. Court House and Post Office, etc., building at Denver, Col.," and addressed to W. J. Edbrooke, Supervising Architect.

Water-Conduit.—Sealed proposals will be received by the City of Savannah, office Water-Works, Savannah, Ga., until eleven (11) o'clock a. m., Aug. 26, 1891, for the construction of a Water Conduit of masonry, on masonry and timber, having an internal diameter of approximately six (6) feet and a length of three thousand (3,000) feet, more or less, all to be in accordance with general specifications on file in the Water Office at Savannah, Ga., or which, with other information, can be obtained from Thos. T. Johnston, Consulting Engineer, at Room 29, No. 171 La Salle St., Chicago, Ill. Proposals must be made in accordance with aforesaid general specifications. Proposals must be accompanied with a cash deposit of two thousand ($2,000) dollars or a certified check for two thousand ($2,000) dollars drawn in favor of the properly authorized agent of the City of Savannah, to be returned or retained in accordance with the general specifications. No proposal will be entertained unless the party furnishing it can offer evidence satisfactory to the Mayor and Board of Aldermen of the City of Savannah of his ability, and that he has the necessary facilities, together with pecuniary resources, to fulfill the conditions of the contract and the specifications, provided such contract should be awarded to him.

The right is reserved to reject any and all proposals not deemed to the best interests of the city.

James Manning, Superintendent.

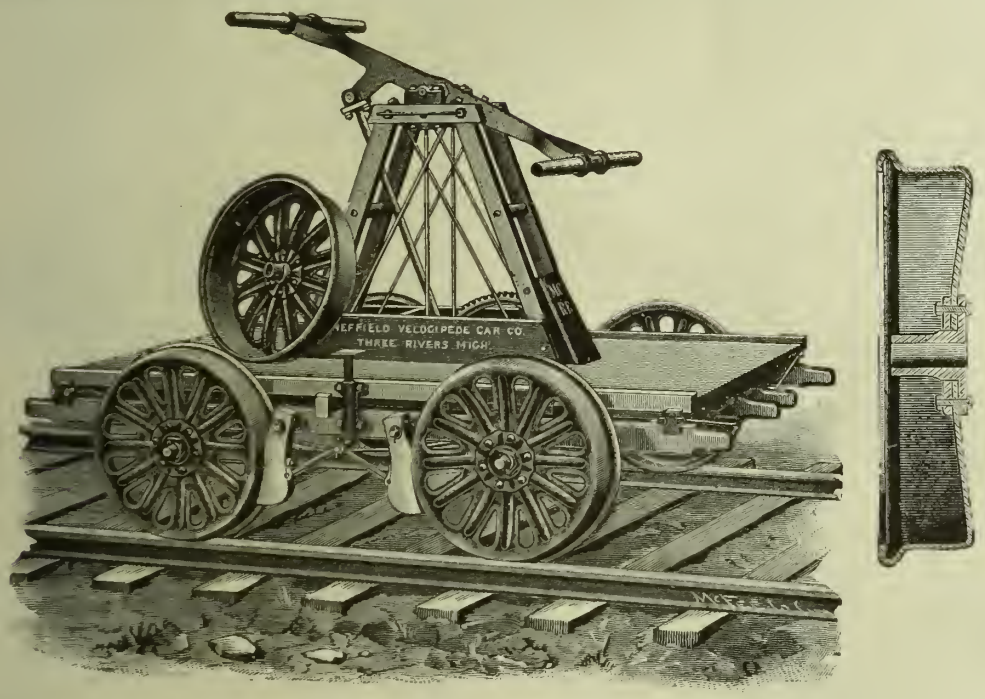
AUGUST 29, 1891. **The American Engineer.** VOL. 22, NO. 9.

A NEW STEP IN METAL WORKING.

It is well known throngh historical and antiquarian researches that the ancient inhabitants of the earth possessed a knowledge of certain things in the working of metal, that have been lost to those who snceeeded them, sometimes entirely; sometimes only in part. Among the former may be mentioned the act of welding copper, which the ancients possessed, but which has been lost completely, although thousands of dollars have been expended in the search for the process. Of the latter class are some secrets in the working of steel, for although we can do many things with this material that they conld not, and in most respects these processes have been carried to a high degree of perfection, yet there are those who claim that the famous blades of Damascus cannot be equalled by even all onr boasted progress in this wonderful nineteenth century, called though it be the "age of steel."

Be that as it may, the observing person can in this line, as with every other, constantly see advances made, and at every turu it is more plainly evident that additions are made to the world's stock of knowledge. A step in advance has evidently been made in the matter of wheels, by the Sheffield Velocipede Car Co., of Three Rivers, Mich.

In railroad hand cars, lightness, strength, and



speed are the qualities aimed at, but a great obstacle in the path of the first disideratum has been the wheel. Strength has been easily attained by the use of cast iron, but wholly at the expense of the weight. Many experiments have been made to overcome this difficulty, and the introduction of the wood center steel-tired wheel made by the Sheffield Velocipede Car Co., which is well known to all railroad men, went a long way towards solving the problem.

This firm have now, however, gone a step further in this direction, and after many expensive experiments, have succeeded in producing a wheel from a single sheet of steel, which we illustrate this on page, both in section and in use on the car. A sheet of proper thickness, to give sufficient strength is sheared to circular shape and passing through a series of formative processes is brought to the desired shape, the center being corrugated to give increased stiffness, as shown. A hub, drop forged from a single piece of toughened steel, is then riveted in place and the wheel is complete.

The result is a wheel of exceptional lightness and strength, and a distinct addition to the articles made by formative processes from metal. It is also particularly adapted to use on all kinds of light cars for mining, contractors, plantation, and tramway use, in the manufacture of which the above named firm are specialists.

La Fete Nationale in Paris is the subject of *The Graphic's* Paris letter, published August 22, accompanied by original pen sketches.

STEAM ENGINE ECONOMY.

Some practical suggestions for engineers are offered in an article under the above caption in the *Tradesman*. The writer says:

To do the greatest possible amount of work with the least possible expenditure of fuel, oil and repairs, is what constitutes skill in an engineer. At the same time it does not pay to be too saving with oil or repairs. A few drops, or even pints, of oil saved, will not pay for a bearing melted, a crosshead worn out, or a guide badly cut. It costs considerably more to bore out a cylinder once in a year or two than it does to use a half pint more oil every day. As for coal, none of that will be wasted if the firing is correct, boiler and furnace are kept clean, the former tight, the steam pipes tight and well covered, and all water of condensation carefully drained off. The water should be drained toward the engine, not toward the boiler, and a drop made to catch the water instead of running it through the engine. To make a drop, put a tee on the pipe that drops from overhead; the tee is put on instead of the usual elbow. The pipe to engine is carried out of horizontal opening, while the lower end of tee is fitted with a pipe one or two feet long and a cap and drip attached thereto. Water passing with steam will fall down into the capped pipe, and may be drawn off through the drip.

This drip may be turned into the boiler, no matter whether it is above or below the level of the water line in boiler. If the engine is above water line a check is all that is necessary in pipe leading to boiler below the water line. If the engine is located below the water line a different arrangement of the pipe is needed, that is all. The water will pump itself into the boiler every time. The arrangement of piping that does this is called "the steam loop." I believe it is a patented concern, but will explain its working:

The pipe from bottom of drip, on engine pipe, makes a half turn back upon itself, then rises to the top of the engine room, or above it if possible. At any rate, the pipe must go up at least eight feet above water line in the boiler, and as much more as is convenient. Indeed, this pipe can be run up through the floor or roof of the building, provided there be precaution taken against freezing. From the riser thus described a pipe runs toward the boiler, but it runs nearly level, with just enough pitch to allow the water of condensation to flow along its length. This horizontal pipe is larger than the riser, so as to condense a little more steam and to give the water a chance to collect and separate. The riser does not connect direct to horizontal pipe in the usual way, but it passes up over and enters the top of the horizontal pipe; this is so that no water, once in the horizontal pipe, can flow back to the engine, at least not until the horizontal pipe becomes full, which it cannot do in practice.

A pipe leads from the lowest end of the horizontal pipe to the boiler and enters through a check valve, below the water line. The rig is now completed, and after the engineer has sketched it out he may commence to study its principle. It is well known that if steam is turned into a pipe closed at one end, all the water of condensation will work toward the closed or "dead end," as it is called.

The pipe leading from the drip up into the horizontal pipe, thence to the boiler, practically forms a "dead end" at the check valve, and the condensed steam all works down against the check. Steam passing through a pipe always looses pressure. It is not much, but it always is some, therefore, there is a little less pressure on steam than on boiler side of check valve. Perhaps this difference of pressure is three pounds, or six feet of water. The water of condensation collects in large horizontal pipe, and flows down to the check. Soon there are six feet of water in this pipe, then seven feet, then eight feet. Just then the check valve is lifted and the water runs into the boiler until but six feet of it is left in the vertical pipe. Then the thing repeats itself. A dip valve should always be put into the system, just outside the check valve. If the return does not work rapidly just after starting the engine, blow steam through the return until it is warm, then close the drip and it will work all right. This device can be applied to almost every steam using device, instead of the usual traps. It is a good thing.

In summing up, the things that a man should look out for, in caring for a steam plant, I wish to impress most strongly that a man should first study his plant thoroughly. He should know just where each pipe goes, its condition, and the condition of the boiler. He must study the result of other people's work and methods, and apply them to his own work. He must see that there is no waste of steam or coal, either directly by leakage and carelessness or indirectly by dirty tubes and laziness. He should also study his engine, read what such a machine can and should do, then try to bring his own engine as near as possible thereto. The machinery should be kept in such condition that no shut down and general overhauling will ever be necessary. To do this all little repairs must be made "just before they are needed," and not wait until just after. To do all this, a man must be a good engineer. He must learn something every day, and such a man will pick up knowledge as easily as a shaggy dog picks up dirt. The man who "knows it all" will never make a good engineer. A man must always be ready to learn something new, and often does it from an engineer who knows less than he does. Such an engineer will listen to suggestions and be glad to get advice. He will also think for himself. He "salts down" everything he hears and reads, and in the day of need this knowledge is forthcoming to help him to get to the top, where there always is plenty of room for the fittest.

THE ELASTIC LIMIT.

When engineers first began to test the materials they used in their structures it was very quickly recognized that if a specimen was loaded beyond a certain point it did not recover its original dimensions on removing the load, but took a permanent set. The limiting stress on straining below which no permanent set could be detected on removing the load, was called the elastic limit. Since under these conditions a bar appeared to recover completely its original form and dimensions on removing the load, it appeared obvious to the first experimenters that it had not been injured in any way by the load, and hence the working load might be deduced from the elastic limit by using a small factor of safety.

Experience showed, however, that in many cases a bar would not carry safely a stress anywhere near the elastic limit of the material as determined by these experiments, and the whole theory of any connection between the elastic limit of a bar and its working load became almost entirely discredited, and engineers employed the ultimate strength only in deducing the safe working load to which their structures might be subjected. Still experience gradually accumulated, and it was observed that a higher factor of safety was required for a live load than for a dead one. This was at first attributed to

the effect of impact, and to a certain extent this was no doubt true, since if a moving body strikes a structure, the work stored up in the body must be taken up by the elastic deformation of the structure, which will be correspondingly greater than if the load was gently laid on it. In 1871, however, Wohler published the results of a number of experiments on bars of iron and steel subjected to live loads. In these experiments the stresses were put on and removed from the specimens without impact, but it was nevertheless found that the breaking stress of the materials was in every case much below the statical breaking load. Thus a bar of Krupp's axle steel having a tenacity of 49 tons per square inch, broke with a stress of 28.6 tons per square inch, when the load was completely removed and replaced without impact 170,000 times. These experiments were made on a large number of different brands of iron and steel, and the results were absolutely concordant in showing that a bar would break with an alternating stress of only, say, one-third the statical breaking strength of the material if the repetitions of stress were sufficiently numerous. At the same time, however, it appeared from the general trend of the experiments that a bar would stand an indefinite number of alterations of stress, provided the stress was kept below this limit.

These experiments, whilst they showed that the impact was insufficient to account for the peculiar detrimental action of a live load, and that the statical breaking strength was not sufficient in itself to properly proportion a structure, did nothing towards rehabilitating the elastic limit as a measure of the safe working load of a material. For this it now appears there were several reasons. We believe it was Sir Frederick Bramwell who professed to be unable to say what a horse-power was, because, first, there was the true horse-power of about 22,000 foot-pounds per minute, next there was Watt's horse-power of 33,000 foot-pounds per minute, and finally there was nominal horse-power, which was anything the engine-builder liked to make it. A remark of the same nature might be made with refference to the elastic limit. There is first the maker's elastic limit, which is the yield point of the material as it comes from the rolls; next there is the real primitive elastic limit of the material, which corresponds to the point at which stress ceases to be sensibly proportional to strain, the bar being tested after being brought to a state of ease; finally, there is the elastic limit of the bar after it has been loaded in various ways, which may be anything the experimenter chooses to make it, up to nearly the breaking point.

It is to Professor Bauschinger, of the Munich Technological Laboratory, that we owe the proof of the fact that the elastic limit has nothing whatever to do with the breaking down point with which it is so commonly considered as identical. Professor Bauschinger defines the elastic limit as the point at which stress ceases to be sensibly proportional to strain, the latter being measured with a mirror apparatus reading to $\frac{1}{5000}$th of a millimetre, or about $\frac{1}{100000}$ in. This limit is always below the yield point and may on occasion be zero. On loading a bar above the yield point, this point rises with the stress, and the rise continues for weeks, months, and possibly for years if the bar is left at rest under its load. On the other hand, when a bar is loaded beyond its true elastic limit, but below its yield point, this limit rises, but reaches a maximum as the yield point is approached and then falls rapidly, reaching even to zero. On leaving the bar at rest under a stress exceeding that of its primitive breaking down point, the elastic limit begins to rise again and may, if left a sufficient time, rise to a point much exceeding its previous value.

This property of the elastic limit of changing with the history of a bar has done more to discredit it than anything else, nevertheless it now seems as if it, owing to this very property, were once more to take its former place in the estimation of engineers, and this time with fixity of tenure. It had long been known that the limit of elasticity might be raised, as we have said, to almost any point within the breaking load of a bar. Thus in some experiments by Professor Styffe, the elastic limit of a puddled steel bar was raised 16,000 lb. by subjecting the bar to a load exceeding its primitive elastic limit, and similar cases could be multiplied indefinitely. Most experimenters, however, had overlooked the importance of the fact that a bar has two limits of elasticity, one for tension and one for compression, and it was reserved for Professor Bauschinger to determine whether the raising of the elastic limit in tension had any effect on the limit for compression. Taking a number of bars as received from the factory, these bars were first loaded in tension until stress ceased to be sensibly proportional to strain. The load was then removed and the bar tested in compression until the elastic limit in this direction had been exceeded. This process raises the elastic limit in compression, as would be found on testing the bar in compression a second time. In place of this, however, it was now again tested in tension, when it was found that the artificial raising of the limit in compression had lowered that in tension below its previous value. By repeating the process of alternately testing in tension and compression, the two limits took up points at equal distances from the line of no load, both in tension and compression. These limits Banschinger calls natural elastic limits of the bar, which for wrought iron correspond to a stress of about 8½ tons per square inch, but this is practically the limiting load to which a bar of the same material can be strained alternately in tension and compression without breaking when the loading is repeated sufficiently often, as determined by Wohler's method, and it is now possible to explain why the bars break at such unexpectedly low loads when thus subjected to alternating stresses. As received from the rolls the elastic limit of the bar in tension is above the natural elastic limit of the bar as defined by Bauschinger, having been artificially raised by the great deformations to which it has been subjected in the process of manufacture. Hence when subjected to alternating stresses, the limit in tension is immediately lowered, whilst that in compression is raised until they both correspond to equal loads. Hence in Wohler's experiments, in which the bars broke at loads nominally below the elastic limits of the material, there is every reason for concluding that the loads were really greater than true elastic limits of the material. This is confirmed by tests on the connecting-rods of engines, which of course work under alternating stresses of equal intensity. Careful experiments on old rods show that the elastic limit in compression is the same as that in tension, and that both are far below the tension elastic limit of the material as received from the rolls. It thus appears that those engineers who have discarded the idea of the elastic limit as a measure of the working strength of a bar, and have proportioned their structures from the results obtained by Wohler, have really in spite of themselves been working on the very assumption they professed to discard. "Thus the whirligig of time brings in its revenges."—*Engineering.*

SADDLE BOILER CIRCULATORS.

Experienced steam-users who endeavor to work their boilers to the best advantage well know the importance of observing the following rules, in order to secure the economical production of steam—First, to take all possible means to prevent scale forming on the plates, and, second, to promote and keep up an active circulation of the water inside the boiler, in order to maintain the plates at an even temperature all over. The neglect of these apparently simple matters means disaster sooner or later. Many devices have been introduced from time to time to overcome the evil of bad circulation, and one of the latest of these is Thwaite's saddle circulator, by the use of which, it is claimed, the difficulties experienced, so far as internal-flued boilers are concerned, are overcome.

The saddle circulator consists of an outer covering of strong sheet iron, stiffened with tee iron, and curved to the radius of the flue, so applied as to leave a space of two inches or so between the flue and the saddle. The saddle runs about three-quarters round the flue, leaving the lower end of the furnace free, and at the top the saddle finishes abruptly just above the water-mark, while a center piece of sheet iron running the whole length of the flue divides the water, and creates two separate and distinct passages. By this device the water between the flue and the saddle is quickly heated, and rises to the top until it issues from the opening with great velocity, a constant and rapid circulation being maintained. The chief merit of the device consists in its usefulness for preventing incrustation, the constant rush of the currents of water effectually preventing the deposition of the objectionable and highly dangerous scales. The patent is applicable to all kinds of boilers, including marine. Boiler incrustation has proved a knotty point to deal with hitherto, and the success of the saddle circulator in actual practice is a matter for congratulation.—*The Steamship.*

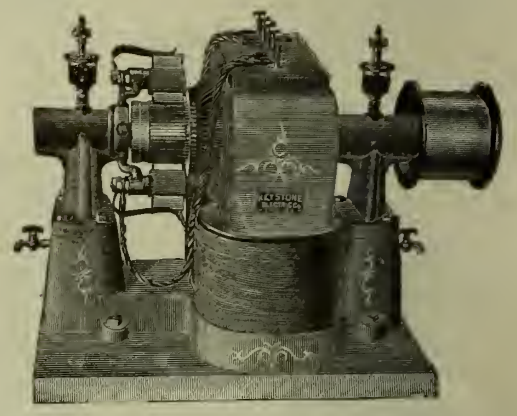
THE KEYSTONE REVERSIBLE ELECTRIC MOTOR AND ELEVATOR.

The accompanying illustrations, in this column and on opposite page, show the new Keystone* reversible electric motor, together with their electric elevator and motor in place, for which patents have been applied for.

The Keystone is claimed to be the only elevator motor operated without rheostat, or other outside resistance, the current being turned into the motor by means of the switch mechanism used in reversing the motor.

A skilled operator is not required to run the elevator, as the operation of the motor is absolutely safe and reliable, the controlling and reversing switch being connected to and operated simultaneously with the brake mechanism of the elevator, by means of the ordinary hand rope thereof, or by means of any of the ordinary devices used in starting and stopping elevators. The motor receives the full force of the current without injury and without any danger of burning out the armature.

This elevator motor, in point of durability, efficiency and economy of operation, is claimed to be



superior to any made for this purpose. All parts of the machine are constructed in the most careful manner, and especial care is taken with the armature bearings, which are made of extra length and size, and they are provided with either sight-feed oil cups or automatic self-oiling bearings, and with ample oil cellars, so that there is no waste of oil.

This motor is adapted to be connected with elevators or hoists of ordinary construction, either by belt (as illustrated in the accompanying cut), by gearing, or by coupling the armature directly to the end of the driving shaft of the elevator or hoist as desired.

The controlling and reversing switch mechanism is simple in construction, substantially made with large and ample contact surfaces, so that it is not liable to get out of order. And the elevator can be instantly started or stopped at any point without the slightest jerk or jar, and reversed and started in the opposite direction with perfect safety.

All machines are carefully tested and the connections numbered before they leave the works, and directions are given so that any experienced wireman can readily connect up the machine.

In operation, this motor only runs while the elevator is in actual use, the motor stopping when the elevator stops, consequently no current is used in running machinery when the elevator is standing still, thus economizing not only in the use of the current, but in the wear of the machinery.

These elevator motors are made in standard sizes of 3, 5, 7½, 10 and 15 horse power; other sizes being specially built to order.

The Keystone Electric Co. have placed these motors on the market after thoroughly testing them. And, moreover, they have been in operation for

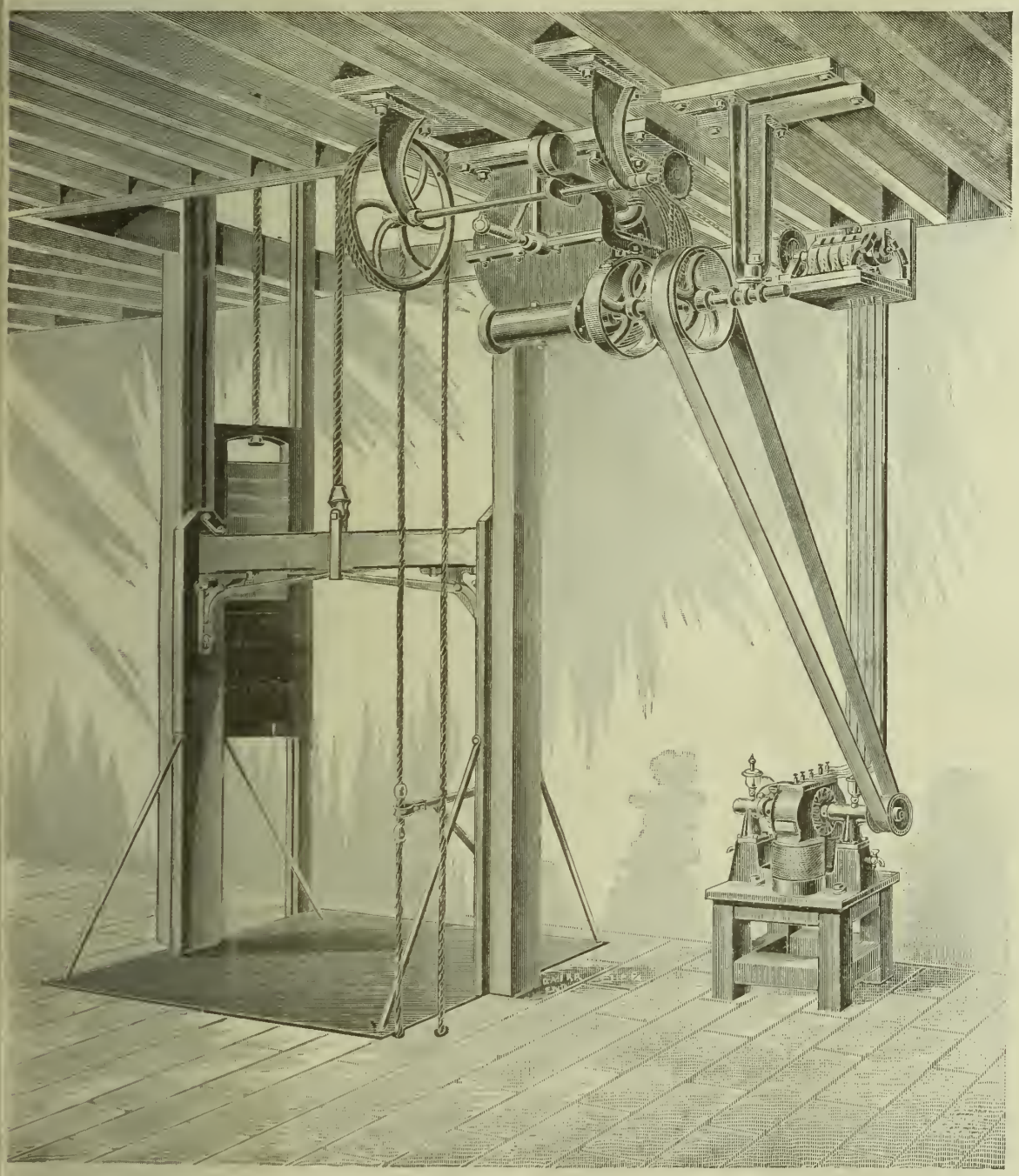
*The Keystone Electric Motor Co., Erie, Pa.

several months at Pittsburg, Erie, and elsewhere, giving splendid satisfaction. And, as recorded in our Electrical Notes, in another column, the Keystone motors are already in demand.

An electric motor suitable to run elevators has been greatly desired, and eagerly looked for, for some time. And we have much pleasure in publishing this brief illustrated description of this welcome new comer in the field of electrical appliances.

FLAME CONTACT.

Some three years ago Mr. Thomas Fletcher, of Warrington, England, made a series of very interesting experiments, says the *Mining and Scientific Press*, which showed in a most unmistakable manner; that notwithstanding when the most intense flame of boiler furnace, or even blow pipe flame,



was urged against the surface of any vessel containing water, there was always existing, between the flame and the surface of the vessel, an impenetrable cold zone of space. This extraordinary fact was quite new and unexpected, and is of the utmost interest and importance to steam-users and boiler-makers. It was shown that a paper label will remain on the bottom of a tin or copper kettle placed on a sharp fire, until by drying, it gradually becomes loosened, and loses it contact with the metal, and so becomes burnt. Care, of course, must be taken that the paper and paste must be very thin, and the latter perfectly dry. Gum will not answer, as it will swell, rise up and burn.

The important problem to be solved, is to discover what the actual temperature of this cool and flameless zone is, and whether this practically wet blanket can be removed. Efforts to remove it have been partially successful by the use of projecting studs, or webs of definite proportions. Experiments have shown that that flame contact can be made with the ends of copper rods or wires. four diameters in length, made to pass through a water-containing vessel into actual contact with water within. Paper placed upon the outer ends of such wires is soon charred. It has further been proved that the surface of the rods so presented to the action of flames is about six times as effective as the same area of surface on a boiler or boiler tube.

It has moreover been quite satisfactorily shown that the evaporating power of any properly proportioned studded or ribbed plate has no limit except the practical one of removing the steam quick enough to prevent it lifting the water bodily out of the boiler.

It was also shown in these experiments that not only the maximum temperatute can be determined by the presence or absence of charring of known organic substances, but also the thickness or depth of the cold zone can be measured by using paper of different thicknesses pasted to the surface of the vessel. When the paper used is thicker than the depth of the cold zone, the surface is charred or completely burnt to an invariable depth by each source of heat; but if this charred surface is cleared off, the under part will be found perfectly white and clean, and on again directing the flame on this clean surface, it remains untouched.

The experimenter, Mr. Fletcher, further says: "The cold zone, although impassible by flame, is powerless to resist the carrying of heat through it by solid bodies, and while the blow-pipe flame is being directed on the paper without the slightest effect, a wire passing through the flame and touching the paper will burn it instantly and completely, although the actual temperature of the wire must of necessity be far below that of the blow-pipe flame.

"The extraordinary part of the whole series of experiments seems to be the existence of a zone of cold against all surfaces of metal having water behind them, this space being, to radiate heat and flame, almost as impenetrable as the metal itself is to the water. Some heat certainly does pass, or the water would never boil; but the quantity which does make its way through is very trifling as compared with what would pass, and, in fact, what does pass under such conditions as permit of direct flame contact with the metal.

"The result of these experiments does not fit the ordinary accepted theories of radiation and absorption of heat. The fact is that the high temperature stops suddenly at a very clearly defined distance, the division line being sharply drawn. It cannot be said that the heat is absorbed at a sufficient speed to produce this cold zone, because as a matter of fact, the heat rebounds and is dissipated, to a large extent, sideways, and this rebound takes place at an invariable distance from the vessel, irrespective of the angle at which the flame is driven, and depending only on the force of impact of the flame. If we could imagine the surface of the vessel covered with a layer of elastic material which is compressed by a torrent of small shot driven steadily against it, we get a mechanical representation of the actual state of things between a flame and a cold vessel, additional force of impact reducing the thickness of the elastic layer, but being powerless to annihilate it."

These experiments go far to account for the small amount of work actually realized from the combustion of fuel under a boiler. The small results thus obtained have ever been a problem, unaccountable by any rational theory of radiation or waste of heat in any other hitherto obvious manner. If an actual contact of flame with the surface of a boiler, without any intermediate cool zone, can increase the work six times, as above stated, inventors have an economic problem of the greatest value to work upon.

The experiment of inserting wire rods was made by first drilling holes through a copper vessel and inserting therein wire rods so that they depended four diameters below the outer surface of the vessel, and flattened down with a broad head like a rivet, nearly level with the inside surface. The theory connected with the utility of these rods is as follows: The lower ends of the rods, not being in close communication with the water, can, and do attain a temperarure sufficiently high to admit of direct flame contact, and as their efficiency, like that of the water surface, depends on the differences between their own temperature and that of the source of heat in absolute contact with them. Thus a far greater duty must be obtained for such surface. The heat of the fuel is thus utilized to a much greater extent than by the imperfect flame contact with the ordinary boiler surface.

Of course there are drawbacks connected with the use of rods as described. Says the experimenter: "To put such rods in a boiler-plate necessitates the plate being drilled all over with holes, causing a dangerous source of weakness, as the rods cannot be used as stays; further than this, they would render really efficient examination a matter of extreme difficulty, and would be liable to give rise to frequent and almost incurable leakages; but there is, fortunately, a very simple way to overcome this difficulty. I have found that rods or points, such as I have described, are not necessary, and that the same results can be obtained by webs or angle-ribs rolled in the plates. My experiments in this direction are not complete, and at present they tend to the conclusion that circular webs, which would be of the greatest efficiency in strengthening the flues are not so efficient for heating as webs running lengthways with the flue, and in a line with the direction of the flame."

Eight hundred pauper immigrants from Antwerp are on their way to America, Antwerp (an't were) probably best they should be sent back as soon as they get here.—*Funny Paper.*

A high pressure engine runs by the direct pressure of the steam only. In a low-pressure engine the steam is condensed with water or otherwise, and a vacuum formed in front of the piston, adding from 13 to 14 pounds per square inch to the power of the piston.

The American Engineer.

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CONTENTS OF THIS NUMBER.

ARTICLES:

"MILLIONS IN IT."

Millions of tons of coal are to be saved by the "non-explosive" boiler invented by a Boston crank, named Edward Fales, according to the announcement contained in a six-headed little article in the *Boston Daily Traveler* of the 20th inst. "Results show giant force of heat unlocked;" "Generating steam at very low cost;" and "Overwhelming results," are some of the headings announcing the contents of the little article, which reads as follows:—

"The public are to be given a genuine surprise in the result of the work of Mr. Edward Fales, of this city, in inventing a process of burning air for fuel, it being a wonderful saving of coal in the generation of steam for heating, manufacturing purposes, etc. The results are overwhelming, and the inventor made the following claims at an exhibition yesterday:

"To make steam for engines, also house heaters, the Fales new system evaporates from 14 to 18 pounds of water per pound of coal, while six pounds is the average of other boilers; and the temperature of the steam is 103 degrees above boiling point at 40 pounds pressure, while the steam in other boilers is 57 degrees above boiling point at 40 pounds pressure which makes one pound of the Fales vapor worth more than two pounds of ordinary steam.

"The Fales steam generators are unlike all others having no tubes, flues or coils, also dispenses with eight-tenths of the smoke. The boiler is non-explosive.

"One of the Fales steam house-heaters boils and circulates more water, also makes more steam from one ton of coal than any other type of heater makes from five tons. Many parties have asked for circulars, and Mr. Fales stated that he had issued some. However, the wonderful power and utility of the apparatus can only be shown by a personal inspection of the same.

"The above mentioned devices are in full working size and demonstrated daily at No. 85 Purchase street, Boston, Mass., at 11 o'clock a. m.

"The invention is secured by six patents by E. Fales, and he challenges the owner of any type of steam boiler, steam house-heater in the world to make a test. All credulous people will be well repaid by calling at No. 85 Purchase street."

It is not convenient for us to call. And we are so incredulous as to suspect that the above story is a Boston joke. We give the story this extended publication, so as to keep our readers posted as to the new tales that are told concerning the generation of steam. And we have written to ask Mr. Fales to send us some facts, if he has any of interest.

THE WORLD'S FAIR.

CHIEF OF MACHINERY DEPARTMENT.

At the weekly meeting on Wednesday (last week) of the "president's cabinet"—the Columbian executive committee—the feature of interest was the nomination of L. W. Robinson, of the United States Navy, to be chief of the department of machinery. The nomination was referred, under the rules, to the committee on manufactures and machinery. In submitting the names for confirmation Director General Davis stated that Mr. Robinson is a chief engineer in the United States Navy. He is also President of the Examining Board of the United States Naval Engineers at Philadelphia, and was first officer under General Albert at the Centennial. His experience gained there in the service is just what is required by the Columbian Exposition, and he is generally indorsed by the exhibitors of the Centennial Exposition, and is also recommended by the Navy Department as the best man to-day for the position of superintendent of machinery.

A LICENSE THIEF ARRESTED.

One Henry J. Pate, who lived at 1624 South 9th Street, St. Louis, has been arrested on a charge of stealing an engineer's license belonging to Henry J. Hassenfurber of 1818 South Third street, St. Louis. On August 7 Hassenfurber's license was stolen from the boiler-room of the Detmer-Wuerpel machine shop at 1607 South Third street, where Hassenfurber is employed, and Detective John J. Connors and Laurence Schroeder were detailed to look the matter up. Pate is an engineer, but was out of employment and secured work as engineer at Emmett's laundry, 1624 South Ninth street, since the theft of the license was reported. Suspicion attached to him.

Detective Connors visited the laundry and was informed that when Pate applied for the position he was asked if he had a license. He said he had one at home and would bring it, which he did and was employed. Connors called on Pate, who took him (Connors) for a boiler inspector. The detective asked to see Pate's license, and Pate said it was at home. Connors told him to bring it at noon, which he did. Connors called again and was shown the license by Pate. Connors says that Hassenfurber's name had been erased and Pate's substituted, also that Pate's suspicions became aroused by the detective's close scrutiny of the license, and that he jerked it from where it was hanging on the wall and threw it in the fire. Connors had taken the number on the license, however, and a reference to the records showed, he claims, that it was the number issued to Hassenfurber. Returing to the laundry he arrested Pate, and locked him up.

MAGNOLIA is a beautiful flower, and a handsome mounted picture of it has reached us, with the compliments of Magnolia Anti-Friction Metal Co., New York.

ENGINEERS, LOOK OUT!

We advise our readers to be on their guard against the party whose name appears in the following advertisement:—

"ENGINEERS!

Engineers can obtain situations if they have passed examination. Zwicker's Revised Practical Instructor will positively enable you to pass one; get only the genuine; worth ten times its cost; by mail $1. Agents wanted.

WALTER G. KRAFT, Publisher,
112 Van Buren Street, Chicago."

He is not in Chicago, or else we would ask the officers of the law to honor him with a call. The last we heard of him he was operating in St. Louis. An engineer in that city writes to us as follows:—

"That man has done more to injure engineers than any one I know of. He has advertised and started a class to instruct inexperienced men so as to be able to stand an examination, and get their license, without any practical knowledge of engineering. The engineers got after him here, and stopped it, but not till a number were licensed before the trick was found out. The victims get no practical or useful instruction at all, and when they found out that a license will not run an engine, they considered they had been swindled."

A NOISELESS MOTOR.

A new and beautiful car, manufactured by the Short Electric Railway Company, was on the streets yesterday afternoon, says the Cleveland *Leader*. If it proves to be the success that it appears to be, it marks an important era in electric street railroading. It is equipped with the Short gearless motors, which are now attracting attention from street railroad men all over the country, bringing to this city many prominent financiers, as well as engineers and railway officials of various degrees. Even Europe and Asia are interested, recent visitors and correspondence having lately been received, including tramway managers from England, France, Germany, Bangkok, Siam, and Tokio, Japan.

The peculiar value of the new motor lies in the entire absence of the toothed gearing which has been so heavy a burden on the railroad companies in repairs and upon the public in noise and clatter. The motor runs as quietly as a horse car without any of the whir and rattle of machinery which is so objectionable upon the Cleveland lines. It is said that the cost of repairs is reduced 75 per cent.

For two or three hours the Short car was put into heavy service on the Johnson lines. A trail car was attached and both cars loaded to their full capacity, "the gearless" easily taking the heaviest grades and sharpest curves to be found in the city. At one point the trail car left the track. In order to test the new motors the brakes were set tight upon the trail car and the full load was drawn on the track and around a curve with entire ease. Hon. Tom L. Johnson, the president of the Brooklyn street railroad, was an interested spectator, and was thoroughly delighted by the remarkable tests, particularly the small amount of electric power taken by the motors. Professor Short himself handled the car throughout the run.

The car itself is very handsome, having plate glass windows and special brass trimmings. It is painted the standard Pennsylvania Railroad color, and is lettered with the Short Company name and the words, "Gearless Motor, Noiseless," on each dashboard. The car is to be sent to various parts of the country for exhibition before railway men, its first destination being Albany, N. Y., where a large equipment contract is pending.

CYLINDER LUBRICANT.

Too many engineers behind the times still use tallow as a cylinder lubricant, says an exchange, and by so doing run a great risk of eventually destroying the engine, as the several fatty acids, stearic, oleic, margaric, etc., of which tallow is composed are almost sure to eat out the valve seat, piston rings and other parts of the cylinder. Some good mineral oil should be used, which is known to have a reputation.

MODERN LIGHT.

By Leo Silberstein.*

From Grecian mythology we learn that Prometheus stole fire from Heaven where the gods guarded it jealously. Prometheus? Presumably some great discoverer, the Edison of a prehistoric age. What he then achieved may have created just as much admiration and wonder as we experience at sight of the incandescent American lamps. How have these wonders been achieved?

Even in old Homer's time tallow candles were a little-known luxury, and Ulysses returning to Ithaca to the halls of his fathers, surveys the wine-stained countenances of his companions, in the ruddy glare of flickering chips and bundles of twigs. How different now! A cascade of brilliant rays radiate from flowers of fabulously wondrous beauty, with incandescent lamps in their interior, falling on facets of crystal glass, on mirrors, on gold frames, on marble statuary, and porcelain figures, covering them all with a halo of splendor. We are in the age of electricity! Electricity! The word suggests a secret revelation of the wonders that surround us —a dream of new powers with which science will invest us; a new authorization of man to assume control over nature, and to mould the conditions of his existence into richer and more attractive forms. And now, how do we produce this uncertain immaterial substance that can dazzle like the sun, strike like the lightning? Its origin is as incomprehensible as its character. The mere contact of two metals produces electricity, the friction of two bodies upon each other, whether they are hard like glass, or fluid like water, the heating of certain mineral crystals, the revolution of one glass disc upon another under certain prescribed arrangements; all these generate electricity. Everywhere in earth, air, fire, and water, we are confronted with the evidence of the presence of this uncertain force which appears only to disappear in the great body of the all-mother earth from whose womb issues all that lives or breathes; to whose womb whatever has life, or force, or energy, must sooner or later return.

For industrial and illuminating purposes, electricity is produced by dynamo machines. The fundamental idea of these wonderful contrivances is that wire spools are maintained in revolution past strong magnets. Whenever the spools approach or withdraw from the poles of the magnet, a current of electricity originates in the wire.

To keep a wire spool revolving past a magnet would be amusing child's play if there were no hindrance, and electricity might be generated very cheaply in a continuous current; but with the increase of the current in the wire spools, there is generated a corresponding antagonism between the magnetism of the iron magnet and the electricity of the wire. The wire strives to go over the shaft, but to enable it to do so, a force is required proportionate to the force of the electricity generated. This required force is supplied by motors, steam-engine, wind-mill, water-wheel, or other power.

In a central station for lighting a city or quarter of a city, we witness a whole series of direct transformation of power from one form into another. Coal is burnt, and the heat thus generated converts water into steam, and gives the steam elasticity. This elasticity operates the machine, precisely as men or horses might; in fact, it performs labor; and this labor employed in revolving the wire spools, generates or is converted into electricity. This whole series of processes may be reversed and electricity converted into heat for cooking, or into power for operating machinery. Endless are the applications of which electricity is susceptible, for electricity, heat, light, steam, the chemical union of elements are all intimately related; they are capable of performing labor precisely as labor is required for their production.

Light, although seemingly so unsubstantial and powerless, is labor, and requires force to generate it as much as wood-chopping or verse making. Every ray of light that vibrates in space is as full of force and energy as the axe of the woodcutter in its swing. Every ray that comes to us is the product of chemical labor applied to distant stars by elements such as oxygen, carbonic acid, etc., in the fierce tumult of chemical union and decomposition. Even to this day, savages generate fire by the sweat of their brow through the rapid continuous friction of two bits of wood.

The day will assuredly come when electricity will be generated directly from the heat of burning coal without the intervention of steam or dynamos; something has, indeed, been already achieved in this direction.

Berlin may be said to be the birthplace of dynamo machines as well as of the electric railway, and of other achievements in electro-technology in which department the illustrious name of Siemens is unrivaled.

The Berlin Electric Works include five central stations, in which the needed electricity for the supply of the city is generated. In March, 1889, there were in the capital 3,714 arc lamps, and 62,876 incandescent lamps in operation. For motor and illuminating purposes, the five central stations distribute about 8,000 horse-power which will shortly be increased to 18,000.

Eighteen thousand horse-power! What an enormous force. To realize its immensity one requires to institute comparison with a past like that of Egypt whose mighty pyramids were erected by human hands. Such work would be merely child's play, comparatively, in this age. Why Berlin's electric force at this moment performs labor equal to that of 70,000 men. The existing steam power of the world is estimated at 6,000,000 horse-power, equal to 50,000,000 laborers. Where now would be the progress in our culture if we were dependent on muscular force? Labor is capable of producing not only physical light but, being economized may be converted into spiritual or intellectual light; thus machinery not merely economizes production but ministers to the material and intellectual progress of the race.

*Translation in the *Literary Digest*.

MANAGING SAFETY VALVES.

An engineer, speaking of neglected safety valves, said: "Safety valves that stick will stick even though tried every day, if they are simply lifted and dropped to the old place on the seat again. If a boiler should be found with an excessively high pressure, it would be one of the worst things to do to start the safety valve from its seat unless extra weight was added, for should the valve once start, it would so suddenly relieve the boiler of such a volume of steam as would cause a rush of water to the opening, and by a blow just the same as in water hammer rupture the boiler. Such a condition is very possible to occur of itself when a safety valve sticks. The valve holds the pressure, that gets higher and higher, until so high that the safety valve does give way and allows so much steam to escape that the sudden changing of conditions sets the water in motion, and an explosion is the result."

KEEPING UP STEAM OVER NIGHT.

An engineer has been telling a contemporary how to keep up steam in a boiler over night without banking. First, the damper is closed tightly and ashes drawn to the ash-pit door, making it air tight. Then the smoke-box door is opened a trifle, the result being that the engineer had 15 to 25 pounds pressure in the morning. With a setting that is not full of leaks, it should be easy enough to keep up pressure over night without any fuss, and if not, there is some leak somewhere that should be attended to. The leak may be of steam, through faulty connections or in a cracked setting, letting the cold air come in contact with the boiler. Then some engineers have an idea that the top of the boiler should not be covered, and here is an avenue for the heat to escape. I have let the fire under a boiler go out early Saturday afternoon, and on Sunday afternoon have found 25 pounds pressure, and nothing was done but close the damper, furnace door and ash-pit door. The best practice is to bank the fire, but when this is done, there is more to fear of a pressure too high than otherwise. Any one who has a steam-pressure recorder will note that the pressure runs very high during the night, and passing through any of the city streets late at night the hiss of steam escaping from safety valves is plainly heard, and leads to the suggestion that some may be in condition less responsive to the excess in the pressure allowed.

REVISED CONSTITUTION OF THE SUPREME COUNCIL, AMERICAN ORDER OF STEAM ENGINEERS.

ARTICLE I.

Supreme Council Powers.

Section 1. The Supreme Council is the source of all true and legitimate authority in the American Order of Steam Engineers wheresover established. It possesses original and exclusive jurisdiction and power.

Sec. 2. To establish, regulate and control the forms, ceremonies, written and unwritten work, and to change, alter and annul the same, and to provide for the safe-keeping and uniform teaching and dissemination of the same.

Sec. 3. To provide, print and furnish all rituals, forms, ceremonies, cards, odes, charts and certificates.

Sec. 4. To prescribe the form, material and color of all regalias, emblems, jewels and charts.

Sec. 5. To provide for the emanation and distribution of all pass words, and regulate the mode and manner of using the same, and generally to prescribe such regulation as may be necessary to secure the safe and easy intercourse of, and the identification of the brethren.

Sec. 6. To establish the Order in States, Districts and Territories.

Sec. 7. To provide a revenue for the Supreme Council by means of a representative tax on each Grand Council. Charges for supplies furnished by it, and dues for subordinate councils under its immediate jurisdiction.

Sec. 8. To provide for annual returns from each Grand Council and for semi-annual returns from each subordinate council under its immediate jurisdiction.

Sec. 9. To hear and determine all appeals from Grand and subordinate councils when the same are properly brought before it in accordance with the regulations of the Order and to provide by legislation for the enforcement of its decision.

Sec. 10. To enact laws and regulations of general application to carry into effect the foregoing, and all other powers reserved by this constitution of the Supreme Council or its officers, and such as may be necessary to enforce its legitimate authority over Grand and subordinate councils under its immediate jurisdiction.

Sec. 11. To charter grand councils and to define the territorial extent of their jurisdiction, and to charter subordinate councils not within the territorial jurisdiction of any grand council and to provide a constitution for each subordinate council under its immediate jurisdiction.

ARTICLE II.

How Constituted.

Section 1. The Supreme Council shall consist of.
Sec. 2. All past supreme chief engineers.
Sec. 3. Supreme chief engineer.
Sec. 4. Supreme first assistant engineer.
Sec. 5. Supreme recording engineer.
Sec. 6. Supreme corresponding engineer.
Sec. 7. Supreme treasurer.
Sec. 8. Supreme chaplain.
Sec. 9. Supreme master mechanic.
Sec. 10. Supreme junior master mechanic.
Sec. 11. Supreme inside sentinel.
Sec. 12. Supreme outside sentinel.
Sec. 13. Supreme trustees.
Sec. 14. Supreme Court of the Order.
Sec. 15. Supreme secretary-treasurer of Mutual Benefit.

Sec. 16. The grand chief engineer of each State and one delegate for each 100 members or fraction thereof under its jurisdiction, councils under the immediate jurisdiction of the Supreme Council, shall be represented by the deputy supreme chief of the district. Supreme delegates must be past grand chief engineers in good standing in their respective grand and subordinate councils, and shall be elected as follows:

At the next annual election after the adoption of this constitution and annually thereafter, each grand jurisdiction shall elect in the mode provided for the election of grand council officers, in the constitution of the respective grand councils, one delegate for each 100 members, or fraction thereof, to serve for one year. In the case of vacancy in

the office of supreme delegate, from death, removal or any cause, the grand council which he represents shall determine how such vacancies shall be filled.

Sec. 17. Each officer and supreme delegate shall be entitled to one vote in determining any question before the Supreme Council; and each supreme past chief engineer shall be entitled to discuss any question and have one vote.

ARTICLE III.

All past grand chief engineers duly recognized by the Supreme Council shall be admitted to its sessions and shall be entitled to speak upon all subjects, but shall *not* be entitled to vote.

ARTICLE IV.

No one shall be eligible to any office in the Supreme Council unless he has been duly admitted to the Supreme Council by being either a delegate or a past grand chief engineer.

ARTICLE V.

Duties of Officers.

Section 1. The past supreme chief engineer shall have charge of the Supreme Council chamber.

Sec. 2. The supreme chief engineer shall exercise, as occasion may require, all the rights appertaining to his high office in accordance with the usages of the Order. He shall have watchful supervision over all lodges, grand and subordinate, and see that all the constitution enactments, rules and edicts of the Supreme Council are duly and promptly observed, and that the work and discipline of the Order everywhere are uniform. Among his special prerogatives are the following: To call special sessions of the Supreme Council and to give such instruction and directions as the good of the Order may require. Always adhering to the obligatory usages of the Order, to cause to be executed and securely to preserve and keep the official bonds and securities of the supreme treasurer and the supreme corresponding engineers, to grant dispensations for the institution of new subordinate councils, such dispensations to be in force until taken up by charters granted in lieu thereof by a properly instituted grand council, and to promptly notify the supreme recording engineer and supreme treasurer of the issuing of such dispensations. To grant charters for the institution of grand councils in states, districts and territories where the same have not been established, to manage the contingent fund of the Supreme Council and suspend or remove any derelict or contumacious officer for cause, he having the right to appeal to the Supreme Court of the Order, and to fill any vacancy by appointment until filled by regular election, to appoint and commission a deputy supreme chief for special purposes of instituting grand councils and installing their officers or otherwise as may be required in all the states, districts or territories where councils are established and not having any grand council. He shall at the next regular session present a full record of his acts during recess of the Supreme Council.

He may hear and decide such questions of law as may be submitted to him by grand or subordinate councils under the immediate jurisdiction of this Supreme Council, and all such decisions shall be binding upon the body submitting the same until fully passed upon, being either disaffirmed or reversed by the Supreme Court of the Order. He shall visit all grand and subordinate councils as often as possible, devoting his entire time to the building up and advancement of the Order.

He shall appoint a deputy supreme chief engineer. "The deputy to be under the special supervision of the supreme chief engineer, and perform such duties as the supreme chief may direct."

He shall receive at stated times such compensation for his services as may be decided upon by the Supreme Council, which shall not be increased or decreased during his term of office.

Sec. 3. The supreme first assistant engineer in the event of the absence, death, removal or physical incompetency of his superior, shall act as supreme chief engineer, at all other times he shall perform such duties as may be required by the Supreme Council or the supreme chief engineer.

Sec. 4. The supreme chaplain shall open and close the Supreme Council with prayer, and shall perform the obligating ceremonies as prescribed in the ritual or usages of the Order, and such other duties as comport with his office.

Sec. 5. The supreme recording engineer shall keep a just and true record of all the proceedings of the Supreme Council at each session, and transmit annually to each grand council as many copies thereof as they require, and one copy for each subordinate council in their several jurisdictions, and one to each subordinate council under the immediate jurisdiction of the Supreme Council. He shall preserve the archives, have charge of the seal, books, papers and other property of the Supreme Council, and deliver the same to his successor when required to do so by the Supreme Council. He shall keep a register which shall contain a list of all the charters granted to grand or dispensations issued by the supreme chief engineer for subordinate councils, and a record of all past grand chief engineers and delegates entitled to seats in the Supreme Councils. He shall attest all necessary official papers and documents, perform such other duties as are required by the law and regulations of the Order as the supreme chief engineer or Supreme Council may from time to time direct. He shall have power to provide himself at the expense of the Supreme Council, with such books, papers, stationery, as are necesaary for the fulfillment of his duties, and keep in his office a copy of the seal of each grand and subordinate council.

Sec. 6. The supreme corresponding engineer shall receive all mail intended for the Supreme Council and shall perform all the correspondence on business relating to the Supreme Council or as ordered by the supreme chief engineer. He shall keep a correct list of the officers and their residence. He shall keep a copy of all communications that he sends and preserve all that he receives for the inspection of the supreme chief engineers and the Supreme Council. All printed matter "supplies, etc.," shall be in his charge. He shall see to the purchase of such as ordered by the committee on printing and shall follow out the committee's instructions or the instructions of the Supreme Council, and he shall attend to the sale of such printed matter and supplies as are furnished by the Supreme Council. He shall keep a correct account of the same; he shall deposit all moneys received with the supreme treasurer engineer, and shall, once a month, forward to the supreme chief engineer a report of his sales, etc., on a printed blank provided by the Supreme Council. The supreme chief engineer shall endorse the report and forward the same to the supreme treasurer engineer, who shall pay the bill at once.

He shall receive such compensation for his services as the Supreme Council may direct, and it shall not be increased or decreased during his term of office. He shall furnish five hundred dollars bond for the faithful discharge of his duties, and at the end of his term of office or to his successor in office, he shall surrender all books and property belonging to the Supreme Council.

Sec. 7. The supreme treasurer engineer shall render to the supreme chief engineer a quarterly statement of the condition of the funds in his hands, and make to the Supreme Council, at its regular session, a true and perfect account of his doings, together with an account of all moneys received and disbursed, giving items in detail. The earnings thereon accrued with interest through investment, to pay all orders drawn on him by the supreme chief engineer properly attested by the supreme recording engineer. He shall place all funds in such moneyed institution, as the board of trustees shall direct. For the faithful performance of his duties he shall give a bond, to be executed and approved before his installation, in the sum of $1000.00, with unexceptional securities, or otherwise the office to be declared vacant and filled by election.

Sec. 8. The supreme senior and junior master mechanic shall have charge of the Supreme Council Chamber, and shall assist the supreme chief to preserve order.

Sec. 9. The supreme sentinels shall have charge of the entrance to the supreme council chamber.

Sec. 10. The supreme trustees shall have charge of all properties belonging to the Supreme Council and shall perform such duties as may be required of them.

Sec. 11. The Supreme Court of the Order shall consist of at least seven members, whose power shall extend to all cases arising under the constitution or laws of the Order. They shall decide all appeals from the decisions of the supreme chief engineer.

They shall decide in all cases effecting the Supreme Council in controversies between grand councils, and shall attend to all the legal duties of the Order.

The full court of the Order shall be elected at the annual session of the Supreme Council.

Sec. 12. The secretary-treasurer of the mutual benefit fund shall have full charge of that fund, subject to the instructions received from the Supreme Council and orders issued during recess by the supreme chief engineer. He shall at once notify all the councils of the death or total disability of a member, giving the name, residence and number of council to which the member belonged. Each council shall forward to him at once the sum of $1.10 for each member on the roll. He shall pay as soon as possible to the widow or heirs the amount due. In case of total disability the money shall be paid to the brother disabled.

He shall receive for his services the sum of ten cents, "less his expenses," on each death notice sent. He shall furnish bonds in the sum of five thousand dollars for the faithful performance of his duties. He shall make a full and complete report at each session of the Supreme Council and at the end of his term of office, or to his successor in office, he shall surrender all books and papers, moneys, etc.

SESSIONS.

Sessions of the Supreme Council shall be bi-annual—The second Monday in May, at such time and place as the Supreme Council shall select. Special sessions must be called in the city where the last Supreme Council was held.

ARTICLE VI.

Section 1. The following committees shall be appointed annually, by the supreme chief engineer:—

Committee on laws.
Committee on finance.
Committee on credentials and returns.
Committee on mileage.
Committee on good of the Order.
Committee on written work.
Committee on unwritten work.
Committee on printing.
Committee on dispensations and charters.

Sec. 2. The committee on law shall, when such subjects are presented to the Supreme Council and duly referred to them, inquire into all cases of infraction of the established laws and regulations of the Order, and recommend such measures as they may deem expedient for correcting the innovation and further consider, and have charge of al matters coming within the purview of that committee.

Sec. 3. The committee on finance shall examine the accounts of the supreme chief engineer, supreme corresponding engineer and supreme treasurer engineer at each session, and whenever required so to do by the Supreme Council. They shall examine and pass upon all bills presented to the Supreme Council when in session, and if correct, report, if approving the same for economy, or creating a remedy by legislation for all extravagant expenditures. They shall make estimates for, and recommend the appropriations of moneys for general or specific purposes during recess of the Supreme Council, and bring down an approximate estimate bond on past results of the probable revenue likely to occur, and no expenditures of any character shall be made in excess of the appropriations thus made until the next regular session.

Sec. 4. The committee on credentials and returns shall examime and report on the returns of the grand councils and subordinate councils under the immediate jurisdiction of the Supreme Council, and the credentials of all the past grand chief engineers and representatives to the Supreme Council.

Sec. 5. The committee on mileage shall compute the mileage per diem of all supreme officers, and at each regular or special session make out a proper, complete and accurate roll of the same and report the amount to which each one on the roll is entitled —and no order shall be drawn for the same until said report is endorsed by the majority of the committee.

Sec. 6. The committee on the good of the Order

shall examine and report upon such portions of the reports of the supreme officer and deputy supreme chiefs, so far as the same relate to the state of the Order, and upon such other matters as may be referred to them, presenting in their reports an exhibit of the conditions of the Order, and recommending such measures for the good and prosperity of the whole Order as they may think the circumstances require.

Sec. 7. The committee on written work shall examine and report on such parts of the reports of the supreme officers or other matters referred to them pertaining to all written work of the Order of a public nature, covering regalias, jewels, charts, certificates, traveling and withdrawal cards, uniforms, equipments or public ceremonials, forms for and details for matters not properly of a secret nature.

Sec. 8. The committee on unwritten work shall examine and report on such reports of the Supreme officers or other matter referred to them of a nature that may be strictly private, or in consonance and keeping with the duties of the name of the committee.

Sec. 9. The committee on printing shall have general supervising charge of, and examine into all matters referred to or coming within the purview of their duties as suggested by their name, make all contracts not otherwise provided for, compare materials, quality and prices, analyze all bills submitted for printing, binding or supplies, establish a standard, style, quality and grade of same, and report their findings and recommendations to the Supreme Council.

Sec. 10. The committee on dispensations and charters shall examine into all proper matters referred to them from the supreme chief engineer or Supreme Council, they shall examine and report on all petitions for dispensations and charters issued by the supreme chief engineer for subordinate or grand councils.

Sec. 11. Each of the above named committees shall consist of three members, and when serving on actual work during a recess of the Supreme Council or of the supreme chief engineer, shall have their necessary expenses paid.

DELAWARE COUNTY COUNCIL, NO. 6, CHESTER, PA.

Following are the officers of Delaware County Council for the ensuing term:

George Ramsey, chief engineer; Joseph Dickinson, first assistant engineer; Chas. Meyer, recording and corresponding engineer; J. F. Eichberg, financial and treasurer engineer; I. R. Williams, chaplain; J. Fenton, Sr. M. M.; G. Hinkle, Jr. M. M.; and Samuel King, inside sentinel. Chas. Meyer,
Cor. Engr.

RUSSELL COUNCIL, NO. 6, MASSILLON, OHIO.

The following officers have been elected and installed for the new Russell Council:

Chas. O. Heggem, C. E.; W. E. Lewis, F. A. E.; John M. Swihart, R. E. and trustee; P. E. Moock, Cor. Engr. and trustee; H. Huppard, Chaplain; M. Elsass, Fin. E.; H. A. Denika, Treas. E.; Harvey Murray, S. M. M.; John T. Heinlback, J. M. M. and trustee; Thos. Murry, I. S.; John Yoste, O. S.; Jas. Switler, M. Switler, Enos Swihart and Thos. Murray, trustees. Frank S. Neal,
Grand Chief Engineer of Ohio.

A "BUREAU OF MEDICAL RELIEF."

A novel organization, with the above title, has been incorporated at Baltimore, Md. It is a sort of insurance against one of the most disagreeable results of sickness, a doctor's bill. Each member of the bureau pays 50 cents monthly for medical attendance; families (unlimited), $10 per annum or $1 per month. The bureau employs a competent medical staff composed of well-known physicians, each member being free to choose from them his attending physician. These physicians will receive regular salaries from the society.

Members of such a society are bound to have the best treatment, for it will be no advantage whatever for a doctor to keep his patients "on hand" as long as possible.

CORRESPONDENCE.

HEADQUARTERS
SUPREME CHIEF ENGINEER.

Syracuse, N. Y., Aug. 22, 1891

Supreme Corresponding Engineer.

To the Officers and Members of A. O. of S. E.,

Dear Brethren:—You are hereby notified that I have this day appointed Brother W. V. Warfield, No. 209 Washington street, Boston, Mass., to be Supreme Corresponding Engineer in the place of Frank S. Neal, resigned. All supplies furnished by the Supreme Council must hereafter be ordered of him. Jefferson Young, Jr.,
Supreme Chief Engineer.

"Scabs."

To the Editor of the American Engineer:

Sir:—A short time ago, an engineer had more work piled upon him than he could do, and he asked the management for more pay and better coal. And they told him to go to h—l.

He went. They hired another man, who did not even know when his damper was shut off. And he let his steam run down without knowing why; and a part of the plant had to be shut down! Now the new "engineer" has his brother to help him, and the two work for one pay—"Scabs." Oh for a license law in our sun flower state.

Cow Boy (Air Brake's Chief.)

Corliss and Slide Valve Engines.

To the Editor of the American Engineer:

Sir:—See, there is another champion of the slide valve in the field. Well, let them come; the more the better. But why don't Reliable give us cards from both engines he speaks of? How does he know that the slide valve is doing more work than the Corliss? I want to see it, and not hearsay. It is evident, from what he says of the speed of both engines, and diameter of cylinder, that the Corliss will do twice as much as the other.

Now he speaks of the break down of the valve gear of the Corliss, and talks as if the old slide valve never broke. I can call to mind of ten breakdowns of engines in this city (Philadelphia) this last year; back of two of them were Corliss engines; the other eight were the "old reliable" slide valves.

How about the steamship that left New York harbor two months ago with the old slide valve? Broke the stem four hundred miles out, and had to be brought back by two ocean tugs. And now the owners are kicking because they have to pay salvage of a few thousand dollars which the "old reliable slide valve" has put them to.

Six years ago an electric plant in this city, put in a new slide valve engine, 16x30, running 100 rev. per minute, run her one year and then threw her out—a "reliable" candidate for the scrap pile—and they put an automatic in its place, and that has been running ever since without any cost whatever with double the load the new slide valve had.

"Old Reliable" speaks of figures to prove these assertions, but he forgot to say the figures were all on one side, for Reliable and Old Slide both seem afraid to go into figures. If they did, they would both come out of the little end of the horn. By the way, what has become of Old Slide Valve? Did he paint his old gal all over with stars and stripes, and did the stripes get entangled in the crank shaft and twist the crank off?

Does reliable know that the longest run on record was made by a Corliss in an electric plant, in the state of New York, where they had to make alterations which made a shut-down of all the small engines in the place necessary? They calculated to make the needed repairs in thirty days, but unavoidable causes prolonged it to forty-one days. And this old Corliss started up at 3 p. m., and ran continuous for forty-one days without a break or hot bearing; 41×24=986 hours. Pretty good, is it not? This engine was loaded from 100 h. p. to 500 h. p., Sunday having the least load.

Why did the large iron works at Pittsburg put in two of Reynolds' Corliss engines of 800 h. p. each, to run their blast furnaces, where they have to make a continuous run of from one to three years, with a stoppage of three times in twenty-four, five minutes each stop? No time there to monkey with its fine frills and feathers, which Old Slide Valve speaks of. Recording Engineer,
Kensington Council, No. 3, of Pa.

[The above letter was received as we were going to press last week, and was therefore written before the publication of Old Slide Valve's letter in our last issue.—Ed. A. E.]

To the Editor of the American Engineer.

Sir:—Well, I think I have won the fight from what I hear and read. The so-called Corliss men have gone out of existence, they have either died a premature death or have gone off to some distant country and buried themselves. "Old Reliable" has hit the nail on the head, and in his summing up he shows us that the confectioner's boilers with the old slide valve hooked on has been doing her work nobly, with over two-thirds the amount of machinery hooked on, that the Corliss next door had; and he hit the nail on the head, that though they have burned more coal by having more exhaust, they do their cooking with exhaust and do not have to use live steam, as in the place of the Corliss. And other point that "Old Reliable" makes, is that with this break in their valve gear, they shut down the coffee mill, causing a delay of ten days for repairs in their busiest time, while the old slide valve kept running right along. He is right that the coffee burned as well as all the other great losses taken in consideration by shutting down, figuring up the salary of each man per day, that it is not to be wondered at that they are all down on this monkey valve gear and in favor of that old slide and comfortable steam plant known as, Old Slide Valve.

Minerva Council, No. 1, San Francisco, Cal.

To the Editor of the American Engineer:

Sir:—Several new members have joined our council.

We have elected Sidney Peard, 518 Third St., as corresponding engineer; in place of S. Kennedy—resigned.

John Oswald.

Bro. Jacks, How is This?

To the Editor of the American Engineer:

Sir:—Will you kindly inform me, if you have any way of ascertaining, how it is that Brother Jacks, residing in the city of Boston, sends his mail out in envelopes of the Windsor Hotel, Philadelphia? This is very puzzling to some, but perhaps he laid in a supply of envelopes while stopping at that hotel last December. It would be well for you to communicate with Mr. Moore, the proprietor of that hotel, and ask him how many boxes of envelopes he missed. Past Supreme Chaplain.

[The chaplain himself is the best man to investigate.—Ed. A. E.]

What Can the Matter Be?

To the Editor of the American Engineer:

Sir:—Will somebody connected with your valued paper kindly inform us how the grand council of the State of Massachusetts got its eye blacked during the last ten days. This has caused very much worriment throughout our Order. If somebody in Massachusetts, who is better posted than the writer, will kindly answer the question, it will be the means of placing our Brother Billy in safe and pleasant company. Yours,

?

Leahey's Table of Water Weights.

To the Editor of the American Engineer:

Sir:—In your issue of August 15th you publish a table compiled by Brother Jerry Leahey, Jr., Supreme 1st Assistant, Perth Amboy, N. J. This table gives the weight of a gallon of spring water filtered at different temperatures (Fahr.) from 32 degrees to 212 degrees. This is the most complete table in existence, and must have taken Brother Leahey a number of months of hard work to compile. This is one of the most useful tables that has ever been published, and the value of it can never be estimat-

ed. I want to call the attention of every engineer in the United States to this table. If they will go through it carefully, they will find that each degree of temperature has been noted, they will find the changes in weight of the water at 32 up to 212 degrees has been a great study.

How much better an article of this kind reads in a mechanical paper than some of those that we have been afflicted with in times past in several mechanical journals. The ridiculous questions that we see published claiming to come from mechanics, as to what we will do in the case of the grate bars falling down or a man hole blowing out and a number of other silly questions. To those who say they cannot find sound knowledge in The American Engineer, I want to call their attention to this table of weights of water, page 68 of your issue of August 15th. I desire to say emphatically that they are the finest tables that I have ever seen published in any mechanical paper. I for one shall put this where it will be handy to find, and hope to find it inserted in some mechanical works that are published from day to day in this country.

I remain, yours,

Old Slide Valve.

Queen City Council, No. 3, Ohio.

To the Editor of the American Engineer:

Sir:—The Queen City Council, No. 3, Ohio, gave a moonlight social on the ta Blevevue last Saturday evening, and had a nice crowd, with lots of music and dancing. We left the city wharf at 8 o'clock, and returned at two in the morning; and every one had a good time—all except Bro. Slover; his feet hurt so he could not dance.

One of Them.

THE EDUCATION OF AN ENGINEER.

Many a contemporary has had its say on this subject. Last of all comes the London *Engineer* which says:

In our impression for June 19th we called attention to a paper by Prof. Hele Shaw on the education of an engineer, read before the Liverpool Engineering Society.* We have since received a copy of the discussion, which occupied the whole evening of the 18th of March. The discussion was not adequate to the paper which elicited it. Discussions seldom or never equal the papers which they follow in interest or value. This particular discussion was remarkable principally for the diversity of opinion expressed as to the best method of teaching a young man his profession. Thus, for example, Mr. Henry West held that the half-time system—six months spent in the shops and six months in college, turn about—was the worst possible method of teaching, while Mr. Higginson stated that, according to his experience, it was the best possible system. Most of the speakers, however, manifested a due appreciation of the value of practical training, as compared with "book learning," and, on the whole, approved of Prof. Hele Shaw's views. The paramount defect of the whole discussion was, however, its exceeding vagueness. That is the defect of all discussions on the subject; and we write now in the hope that those who think, and speak, and write on the education of an engineer may be brought to see how this want of crystallization of thought does harm, and raises false issues, and that, thus seeing, they may mend their ways, and contribute something in the way of reasons, or advice, or information, which shall be of value.

Let us then suppose that a young man of, say, 17 is to be made a mechanical engineer, and that it is known that his principal work will consist in constructing steam engines and boilers. The engines will be of various kinds; the boilers of no single type. It is further to be supposed that he will work steadily up until he becomes a manager, and even ultimately a partner. What is the best training for a young man under these circumstances? We think we may say, without fear of contradiction, that what will best suit him will not necessarily best suit a young man whose life will probably be spent in designing and making iron bridges and roofs. Nor is it likely that his training should be identical with that of a man intending to undertake the construction of cotton machinery or of agricultural implements. In order to avoid being vague, we shall confine ourselves wholly to the consideration of the case presented by the young man who has to make and sell steam engines and boilers. We shall be told by some people at once that it will be of the greatest possible service to this young man to learn all about thermodynamics and dynamics generally. He must also gain a good knowledge of mathematics; and if he combines with this a little sound chemistry, so much the better. There are many other things which are roughly classed under the head of "science" which he ought to learn. Now it is very easy to say all these things will be of use. But no one ever stops to answer the question, of what use? It may startle, and even shock some good people, if we say that in nine cases out of ten a knowledge of thermodynamics is of no use whatever to the maker of steam engines; and that he has absolutely no use for any mathematical knowledge which goes outside the rules of arithmetic; and the reason is that steam engines and boilers are not the result of mathematical investigations, but simply of precedent. What, for example, is the use of teaching a young man how to calculate the proper diameter for a crank shaft, when proper diameters never are calculated, and if they were, the result would certainly be wrong? This may sound heretical, but our readers who are really steam engine makers know that it is true. When a young man goes into the drawing office from the shops, he will find that all the proportions of the parts of the engines and boilers made by the firm are ready cut and dried for him. The prominent idea of some makers is to put in the smallest crank-shaft that can be got to stand. On the other hand, in certain districts a steam engine cannot find a purchaser unless it is of the most massive proportions; no book or college can help our young man here. But, whatever the nature of the demand, no one ever dreams of calculating the diameter of a crank-shaft. A certain diameter cylinder and a certain crank-shaft go together; they have given good results hitherto, why depart from them? If any of our readers will return to Bourne on "The Steam Engine" they will find elaborate tables of dimensions of parts. These are the results of extended practice. The figures represent the best work of the time when they were compiled. Much the same kind of thing exists at this day in every drawing-office. Sizes are either recorded in tables and hung on the walls, or they are to be found on drawings of engines which have already given satisfaction. In designing boilers, again, there are certain cut-and-dry rules from which no one with a reputation thinks of departing. If our readers will take the trouble to compare dimensions of crank-shafts, for instance, in large marine engines, they will find a wonderful sameness. The exceptions are to be met with in the navy, where crank-shafts and other parts are made lighter, with very doubtful advantage, than in the mercantile marine. As to a knowledge of thermodynamics helping any one to improve the steam engine, all available evidence goes to demonstrate the direct contrary, and that all the best work has been done by men who knew little and cared less for thermodynamics. For our suppositions young man mathematical training is of no direct value whatever. It may, however, prove of great indirect value by teaching him how to reason and draw conclusions. But logic would probably answer better. The proper training for our young man is that which teaches him to keep his eyes open; to see what is and what is not successful, either in his own practice or that of other people, and to endeavor in all cases to find out why any method of construction which seems novel has been adopted.

There is nothing like an anecdote for enforcing a lesson. A young engineer, trained in college, saw a certain compound horizontal engine, and this engine pained him because the crank-shaft was much too thick; and there was besides, a third bearing—a short one, it is true, but still a bearing—squeezed in between the cranks. He felt within himself that this was waste of material, and he calculated the strength of the crank-shaft by the most approved formulæ, and he saw that it was ridiculously too strong. The engine was in an exhibition, and, unable to bear the mental strain he got hold of some one who represented the maker—one who, fortunately knew what he was talking about—and to him the troubled youth poured out his soul, and asked why the crank-shaft was so strong, and why there was a third bearing. He was told that the shaft would not run cool otherwise, and, wanting to know why, he was further informed that the shaft would "whip" unless it was very stiff; that the third bearing was introduced to gain still more stiffness, and that if the shaft whipped, experience proved that it would run hot. That young man went away much wiser. He had learned that there were things about steam engines not stated in books, and we have no doubt that he kept his eyes open in future, and learned much that he would otherwise have missed.

In one word, then, the best training for a young engineer intending to make steam engines and boilers, is that which consists in studying the best examples that he can find of steam engines and boilers, and bringing to his assistance, in assimilating what he sees, the practical knowledge which he acquires in the shops. Thus, for example, he sees on an engine a certain form of valve gear. If he is wise he will take thought not only for the mode of action of the gear, but for the way in which it is made. We are not now talking of patented inventions, but of familiar details. He has, for example, to wait at a railway station, and possibly half a dozen different engines stop at the platform; no two will have their links made or carried in the same way. The chances are that if he keeps his eyes open he will get a hint which will enable him to cheapen and improve the valve gear he is fitting onto a certain small winding engine now in his own shop, and so on. Nothing is more valuable to the engineer than a power of observation, and this should be backed up by the ability to make free-hand sketches with accuracy and dispatch. That is an art which is hardly ever taught as it should be.

It may perhaps be urged that we are advocating simple robbery of ideas, but we do nothing of the kind. The man who is unable to do anything but steal ideas will soon find that servile imitation means bankruptcy. Every engineer, every professional man, every artist depends for the production of good work on the labor not only of his predecessors, but of his contemporaries. The man who, shutting his eyes to all that is going on around him, resolved to elaborate a steam engine out of books and his own brains, would produce nothing worth having. The true education of the engineer who makes steam engines and boilers, lies not in acquiring a knowledge of mathematics or thermodynamics, but in seeing how steam engines and boilers have been made, and how they are made now, and learning why they are made in any particular way. If his powers of observation are backed up by that intuitive sense of mechanical fitness which has been termed mechanical instinct, then he will be on the road to success.

Where there is time available, considerable benefit can, as we have often said, be derived from a college course, but this applies far more to the youth who is absolutely ignorant of all that concerns mechanical engineering, than to the youth who at least knows that a locomotive has not "got a lot of wheels and things" inside the boiler; nor does what we have said apply to other branches of engineering. A civil engineer, for example, has to resort daily to mathematics in doing his work, and a great deal of civil engineering can be learned better in college than anywhere else. The bridge builder, ignorant of mathematics, and lacking knowledge of graphic statics, will be continually at a loss. The non-mathematical shipbuilder is a monstrosity. Herein lies, indeed, one of the greatest obstacles to success in college training. The course which suits one set of students is useless for another set. It becomes, in a word, impossible to lay down any hard-and-fast rule. It may be taken as certain, however, that much useless knowledge is in all cases forced upon the student; and this does not represent the whole mischief, because the acquisition of this brain lumber not only shuts out that which is really good, but tends to produce a habit of thought which is radically bad. If the student once acquires the custom of resorting to books for everything, he will destroy his powers of observation. He will literally give up the substance for the shadow.

Finally, we would suggest to our readers, and to

*Reported in The American Engineer for March 28 and April 25, 1891.

professors particularly, that they should formulate their views on any particular branch of instruction, and show in what way that particular branch will be of service to a young man. We would suggest, for instance, as a thesis, "The way in which a mastery of 'Clausius on Heat' will enable an engineer to improve the steam engine." But other examples may be taken, as, for instance, "The effect which Cotterill's treatise on the steam engine has had on the development and management of engines in the navy." A discussion based on information of this kind, properly carried out, could hardly fail to do good by bringing facts before the world, instead of vague expressions of opinion.

DEPARTMENT RULES OF THE EXPOSITION.

Revised rules for the government of privileges and concessions on the Columbian Exposition grounds were published in The American Engineer for May 30, last. The following are the "Department" rules, or laws governing the officials of the Fair, which have just been adopted by the board of control. These new rules also provide for the application for space and issuance of permits for exhibits.

Official Regulations.

1. The correspondence of the different departments will be conducted on stationery that will bear on the head thereof the following:

World's Columbian Commission,
Office of the Director General of the Exposition,
Chicago, U. S. A.

Figure of Globe.

Department of———
———Chief.

2. All subordinates and employes in the several departments shall be appointed by the Director General, and the salary of such fixed by him. But the name of no subordinate or employe shall be placed upon the pay-roll until the salary shall have been approved by the board of directors of the World's Columbian Exposition.

3. All supplies needed for each of the several departments shall be furnished upon requisitions made to the Director General on a form to be prepared and approved by him for that purpose. Each department shall also submit from time to time, as required by the Director General, estimates of all expenses, other than such fixed expenses as have been theretofore duly approved, to the end that the proper examination and consideration may be given thereto by the only constituted authorities.

4. All maps, charts, prints, and other data relative to the ground plans of the exposition grounds and of the buildings and floor space therein which may be needed by any department chief in the administration of his department will be procured upon application made by such chief to the Director General.

5. The chief of each of the several departments will exert his best endeavors at all times and in every proper way to exploit the work properly belonging to each of their several departments, and to this end will from time to time, as occasions requires prepare such circulars, communications, pamphlets, or other papers intended for general or special distribution and submit the same to the Director General for his approval, and when approved by him and the appropriation for the expense incident to their printing and distribution shall have been authorized by the proper authority and shall have been printed, they shall be forthwith distributed under the direction of the department chiefs suggesting the same.

6. Chiefs of the departments will forward to the Director General, not later than the 5th of each month, report in triplicate, giving in detail the progress of the work of their departments, showing the condition at the date of the report and the progress made during the month. And they will likewise transmit with such report a statement in duplicate showing the detailed expenses of their respective departments for the preceding month, which shall be certified to by the chief. One of such reports accompanied by one of the statements of detailed expenses, shall be transmitted to the President of the World's Columbian Exposition for the information of that body. The department chiefs will also retain in their respective offices a record of these reports and statements of expenses.

7. Each department shall at all times be open to inspection by the appropriate committees of the National Commission and of the board of directors of the World's Columbian Exposition respectively.

8. A meeting will be held on Tuesday of each week at 4 o'clock in the afternoon, in the private office of the Director General, for conference and consultation, at which meeting the punctual attendance of the chief of each department is expected and enjoined.

9. All departments shall be open for business at 8:30 o'clock a. m. and remain open until 5:30 p. m. daily, except Sundays.

10. Chiefs of departments will make frequent inspection and note the progress of work on the buildings of their respective departments, from the foundation to the completion thereof, and report the result of their inspections and observations to the Director General.

11. The traffic manager of the World's Columbian Exposition will issue such transportation to and from Jackson Park as the officers of the several departments shall require in the prosecution of the business of their respective departments upon the written request of the chief of such departments, presented to and approved by the Director General.

12. All applications for space and correspondence relating thereto shall be addressed to the Director General, who will cause an accurate record thereof to be kept in his office, and will direct the references of such applications and correspondence with exhibitors, and shall supply blank applications for space in such form as the Director General shall approve.

13. Allotments of space for exhibits for each of the several departments shall be made by the chief thereof, subject to the supervision and approval of the Director General, who will issue all permits therefor.

14. The chief of each department shall likewise subject to the approval of the Director General, exclusively direct conduct and supervise the installation of all exhibits within his department.

15. On all questions of controversy that may arise, either touching classification, the allotment of space or installation, an appeal may be had to the Director General, whose judgment and conclusion shall be final, subject, however, to the paramount authority of the National Commission, its Executive Committee or its Board of Reference and Control.

16. All rules and regulations prescribed by any department chief for the government of his department, or defining the rights and privileges of exhibitors therein, must be submitted to and be approved by the Director General before promulgation thereof.

TO SHOW THE PRESENCE OF ACIDITY IN BOILER WATER.

Our British contemporary *Industries* has this to say about an indicator of activity in boiler waters:—

As is well known, water containing magnesium chloride is injurious to boilers, as the salt dissociates with the production of hydrochloric acid which attacks the plates. In large installations, where systematic purification of the feed water can be adopted, this evil is prevented, but in most cases the treatment in vogue consists in adding caustic soda to keep the contents of the boiler alkaline. An excess of soda is wasteful and otherwise objectionable, and it becomes desirable to be able readily to ascertain when the water in the boiler ceases to contain alkali and needs a further supply. The handiest way to do this would be to have a certain quantity of some indicator always present in the boiler, but, unfortunately, all the usual indicators, such as litmus and turmeric, become decolorized under the influence of water at high temperature and pressure; the same objection applies to Congo red. Dr. Goldberg has, however, found that the sodium salt of paranitrophenol is entirely unaffected either by these conditions or by the salts usually present in feed waters. It is therefore possible, by introducing a sufficient quantity into the boiler, to judge of the alkalinity or acidity of its contents at any given moment by merely blowing the water out of the gauge glass and allowing it to refill. To give a distinct yellow color (the evidence of alkalinity) to the water, so that it may be seen in the small quantity of water in the gauge glass, about 30 to 50 grammes per cubic meter are requisite. The high price of the substance is the bar to its general use at present, the cost of the pure material being about 5s. a pound. As its successful application is not dependent upon its purity, a crude variety could doubtless be produced much more cheaply if a demand arose for it.

THE COLOR OF WATER.

What is the color of pure water? Almost any person who has no special knowledge on the subject will reply at once: "It has no color." Yet everybody knows, either through hearsay or by the evidence or his own eyes, that the ocean is blue.

Why the ocean looks blue is a question that few who have crossed it have ever sought to solve, and there are probably many travelers who, though they have seen most of the famous rivers and lakes in the world, have failed to notice the remarkable difference in color which their waters present. Even the ocean is not uniform in color. In some places the waters are green or even yellowish.—*Nature.*

WHAT IS ELECTRICITY?

Is it likely that a professor of the Illinois University can tell? A special telegram from Champaign, Ill., says:

"Professor C. S. Page, of this city, will in a short time deliver a lecture before prominent electricians of Chicago. Professor Page has for years been making a thorough investigation of electricity, but as yet has not made public any results of his researches. He claims, however, to have discovered what electricity really is, and is engaged in writing a text-book on electricity, which will dispute many of the present theories and will put forth some very origiual ideas on the subject."

SCIENTIFIC PARADOXES.

The water which drowns us—a fluent stream—can be walked upon as ice. The bullet which, when fired from a musket, carries death, will be harmless if ground to dust before being fired. The crystallized part of the oil of roses, so grateful in its fragrance, a solid at ordinary temperature, though really volatile, is a compound substance containing exactly the same elements, and in exactly the same proportions, as the gas with which we light our streets. The tea which we daily drink with benefit and pleasure, produces palpitations, nervous troubles and even paralysis, if taken in excess; yet the peculiar organic agent theine, to which tea owes its qualities, may be taken by itself—as theine, not tea—without any appreciable effect.—*Age of Steel.*

In packing the stuffing boxes of piston rods and valve rods, the utmost care should be taken to put in the packing evenly, so that the steam may be prevented from escaping without the necessity of screwing down the glands so tightly as to interfere with the free movement of the rods. The packing should be changed as often as may be necessary to prevent it from becoming hard and gritty as keeping it too long in use may be the means of grooving or creasing the rods, thereby occasioning leakage and consequent trouble.—*Ex.*

A Chicago man has come forward with a novel World' Fair suggestion. Instead of tryirg to build some lofty structure, he says, the thing to do is to dig the deepest hole in the ground on record, say ten miles deep. Besides the mineral bonanza that might be struck, a great many geological problems might be solved, and a lot of money could be made by rigging the shaft with an elevator and taking passengers to the bottom.—*Denver Republican.*

If Edison is right in saying it will be possible both to heat and light a dwelling for 60 cents a year in the near future he is the Economical man we are waiting for.—*Ex.*

LITERARY.

Scribner's Magazine for September contains the fifth and concluding article in the successful Steamship Series, entitled "The Steamship Lines of the Old World," by Lieutenant Ridgely Hunt, U. S. N., a son of the late Secretary of the Navy and Minister to Russia. (It is announced that the Steamship articles, like the Railroad and Electric series, will be issued in a handsome volume.) This number contains three articles on essentially American subjects—on "Odd Homes," from the dug-out to the Adirondack cabin; on "China Hunting in New England," particularly along the Connecticut River valley, with an account of many rare American plates, which it was once the custom to make as souvenirs of important events; and (the third) on the "Present Ideals of American University Life," by Professor Josiah Royce, of Harvard, who pleads for the idealization of our colleges, rather than their further adaptation to practical ends. Other important articles in this issue are "Browning's Asolo," by Felix Moscheles, the artist and friend of Browning, a picturesque and personal account of the little Italian village where the poet's last volume, "Asolando," was written, with illustrations from the author's own water-color sketches; a description of "The City of the Sacred Bo-Tree," by James Ricalton, a veteran traveler and photographer, whose account of this wonderful city in Ceylon is abundantly illustrated; Andrew Lang's "Adventures Among Books," a sort of literary autobiography; the second instalment of the serial story, "The Wrecker," by Robert Louis Stevenson and Lloyd Osbourne; and short stories by Thomas Nelson Page and Charles G. D. Roberts.

BUSINESS TRANSACTIONS.

The new type heavy hoisting engine which the Lidgerwood Manufacturing Company lately placed on the market, has received a flattering reception. Thirteen of them have already been sold in less than a year. The following endorsement from the president of the Vermont Marble Company, Proctor, Vt., Fletcher D. Proctor, son of the present Secretary of War, is notable:

July 31, 1891.

"Lidgerwood Manufacturing Company, New York, N. Y.

Gentlemen:—The two-drum hoisting engine which you send us last spring is a success, and we do not hesitate to recommend it for what you claim for it. It runs two derricks, with one engine, hoisting twenty ton blocks without any trouble 152 feet in a minute and a half.

s with a steam pressure about 60 pounds, 300 feet away from the engine, and am satisfied that with a stronger pressure it would hoist this weight in from a minute to a minute and a quarter. The workmanship of the engine and power is perfect, and we can heartily recommend it. Very truly yours,

(Signed) Vermont Marble Co., Fletcher D. Proctor, President."

The universal favor with which the Hoppes feed-water purifier is held by the steam users is evidenced by the fact of the Hoppes Manufacturing Co, of Springfield, Ohio, just closing contract with the Crystal Ice Manufacturing & Cold Storage Co., at Columbus, Ohio, for one of their 500 h. p. feed-water purifiers' after some very sharp competition with other manufacturers in their line, it is said: Although the Hoppes purifier was very much higher in price, the directors of the Ice Company decided in favor of the Hoppes purifier as stated above. The Hoppes Manufacturing Co. report as among other recent sales the following: To S. N. Brown & Co., Dayton, Ohio, one 250 h. p. live steam feed-water purifier; to Zwick, Greenwald & Co., Dayton, Ohio, one 200 h. p. purifier and one 300 h. p. exhaust steam heater; to Chicago Herald Co., Chicago, Ill., one 300 h. p. exhaust steam feed-water heater; to Sewickley Electric Co., Sewickley, Pa., one 100 h. p. exhaust steam heater; to Gipps Brewing Co., Peoria, Ill., one 350 h. p. live steam purifier, and one 400 h. p. exhaust steam heater; to Matthieseen & Hegeler Zinc Co., La Salle, Ill., one 300 h. p. exhaust heater; to Queen City Electric Co., Cincinnati, Ohio, one 200 h. p. exhaust steam heater; to American Flake Hominy Co., Yellow Springs, Ohio, one 100 h. p, exhaust steam heater; to Baldwin Fertilizer Co., Port Royal, S. C., one 200 h. p. live steam purifier, one 80 h. p. purifier, and one 300 h. p. exhaust steam heater; to the Cincinnati Inclined Plane Railway Co., Cincinnati, Ohio, one 250 h. p. live steam feed-water purifier; to the Richmond Street Railway, Richmond, Ind., one 400 h. p. exhaust steam heater; and to M. Zwicky's Sons, at Springfield, Ill., one 80 h p. live steam feed-water purifier.

J. W. Parker, the Philadelphia agent for The Ball Engine Co., of Erie, Pa., has sold an 80 h. p. engine to the Ivy City Brick Co., of Washington, D. C. Also an 80 h. p. engine to George Kelly & Co., of Philadelphia.

United Railways Car Heating Company.

James Emerson, of Willimansett, Mass., a persevering inventor, has turned over his numerous railway heating and coupling inventions to the newly formed company named in the heading of this article They have a capital stock of $500,000. Mr. Emerson is, of course, a stockholder in the new concern. His car-heating apparatus, which is in successful use by the Connecticut River railroad, will now be pushed with vigor. Mr. Emerson has been for years perfecting devices, one of the latest improvements in the heating apparatus being an arrangement for using the Baker heater when a car is detached and turning on steam from the locomotive when the train is made up again. This is an important arrangement, as many cars are already provided with the Baker heater, and the Emerson system can be added to them with little expense. It also insures warmth in case a train becomes parted or stalled in snow. Mr. Emerson's steam-pipe coupler runs through the buffer, and he has a patent on a coupler for air-brakes that runs over the platform instead of under it, insuring protection to the brakeman, who formerly had to get in front of the wheels to make the connection.

ELECTRICAL NOTES.

A 35 h. p. engine, built by The Ball Engiuc Co., of Erie, Pa., will supply the power for electric lighting for the Norfolk Beet & Sugar Co., of Norfolk, Neb.

A 100 h. p. tandem compound engine, manufactured by The Ball Engine Co., Erie, Pa., is to furnish power for the Beatrice Rapid Transit Co., of Beatrice, Neb.

The Keystone Electric Co., of Erie, Pa., last week, shipped a 2 h. p. motor to Scranton, Pa., also a 5 h. p. motor for the Erie Piano Co., at Erie, Pa.

The Bellaire Gas & Electric Light Co., of Bellaire, Ohio, are installing a 100 h. p. engine built by The Ball Engine Co., of Erie, Pa.

The Hotel Savoy, Fifty-ninth street and Fifth avenue, New York City, have purchased for their electric light plant three 100 h. p. and one 60 h. p. engines through E. T. Copeland & Co., 106 Liberty street, New York. The engines are manufactured by The Ball Engine Co., Erie, Pa.

The Johnson Co., Johnstown, Pa., have just installed a 300 h. p. cross compound Ball engine for their electric welding plant.

The Tuscarawas Electric Light Co., Canal Dover, Ohio, has ordered a 100 h. p. engine from The Ball Engine Co., Erie, Pa.

The *Practical Engineer* is again showing its readers the practical nature of the information given in its columns on the subject of electricity. In last week's issue it is stated that the current for a large electric locomotive, built by the Thomson-Houston Company, is supplied by a 500 volt dynamo, having a capacity of 30,000 *volts*. This is small compared with the capacity of our contemporary for distorting electrical news. *Electrical Review* (London.)

CHICAGO, MILWAUKEE & ST. PAUL RAILWAY.

Electric Lighted and Steam Heated Vestibuled Trains, with Westinghouse Air Signals, between Chicago, St. Paul and Minneapolis, daily.

Electric Lighted and Steam Heated Vestibuled Trains between Chicago, Council Bluffs and Omaha, daily.

Through Vestibuled Sleeping Cars, daily, between Chicago, Butte, Tacoma, Seattle, and Portland, Ore.

Solid Trains between Chicago and principal points in Northern Wisconsin and the Peninsula of Michigan.

Daily Trains between St. Paul, Minneapolis and Kansas City via the Hedrick Route.

Through Sleeping Cars, daily, between St. Louis, St. Paul and Minneapolis.

The finest Dining Cars in the World.

The best Sleeping Cars. Electric Reading Lamps in Berths.

6,100 miles of road in Illinois, Wisconsin, Northern Michigan, Iowa, Minnesota, Missouri, South Dakota and North Dakota.

Everything First-Class.

First-Class People patronize First-Class Lines.

Ticket Agents everywhere sell Tickets over the Chicago, Milwaukee and St. Paul Railway.

American Agricultural Machines Wanted.

A German wholesale firm, with English and German references, dealing in agricultural machines, wishes to buy for cash American agricultural machines of latest and approved construction and invites cheapest offers to be forwarded to F. A. 7071, care of Rudolf Mosse, Berlin, S. W. (Germany).

Map of the United States.

A large, handsome map of the United States, mounted and suitable for office or home use, is issued by the Burlington route. Copies will be mailed to any address on receipt of 12 cents in postage by P. S. Eustis, Gen'l Pass. Agent, C., B & Q. R. R., Chicago, Ill.

An Opening.—A chief engineer of three years' experience in southwest Virginia, east Tennessee and North Carolina would like to meet one or two bright men with $100,000 each who could complete 15 miles of railroad on which $60,000 cash has been expended for grading this season. The present company are local men who have run out of cash, but the project is as good as ever, and the opportunity now occurs to take advantage of their misfortune. No debts are owing, no bonds have been issued, and about $150,000 of local bonuses are promised. The inducements to take hold are: when built this railroad will inevitably be required by the projected extention of a present large system; it will pay handsomely from the start; and, best of all, large mineral and timber properties can now be secured cheaply, whose value would be greatly increased by the completion of this railroad.

I have no money and no financial connections, but have this opportunity and can give the highest professional references. Address Chief Engineer, P. O. Box 360, Bristol, Tenn.

CONTRACTS OPEN.

Iron Bridge.—Proposals for an iron bridge between the counties of Bergen and Passaic, New Jersey, will be received at the court-house, Hackensack, the 8th day of September, at 3 o'clock p. m.. Plans and specifications may be seen at the residence of Albert Bogert, Fairlawn, Bergen Co., N. J., and at the office of James Carroll, No. 10 Ramapo avenue, Patterson N. J. Albert Bogert, chairman of Joint Committee.

Water-Works and Electric Lights.—Sealed proposals for the construction of a system of water-works and electric lights for the city of Metropolis, Illinois, are hereby solicited. The said water and light plants to be constructed in accordance with plans and specifications now on file with the City Clerk of said city of Metropolis, Illinois, and to be seen there only. Bidders must deposit with the clerk a certified check for $500 as an evidence of good faith.

Notice is further hereby given that the contractor must furnish the money to put in said works, and that he will be repaid in a fixed annual rental, to be agreed upon between the parties, after a sum of not less than $5,000 has been paid down in cash by said city, together with interest on the deferred payments.

Bids will be received separately or jointly for the construction of either plant. The said city of Metropolis also reserves the right to reject any and all bids.

Bids to be opened Thursday, September 10, 1891. A. Quante, Mayor, Bart Kerr, City Clerk.

Water-Works.—Sealed proposals will be received by the Chairman of the Water Supply Committee to build a system of water-works for this place, Gainesville, Fla., according to plans and specification on file. Bids will be received and opened on September 1, 1891. The committee reserves the right to reject any or all bids. For copies of plans and specifications and any further information address

A. J. McArthur, Chairman Water Supply Committee.

Sewer.—Sealed proposals will be received by the Common Council of the City of Terre Haute, Ind., Tuesday evening, September 1, 1891, for the construction of about 4,630 feet of brick sewer, varying in size from 2ft. 4in. by 3ft. 6in. to 3ft. 4in. by 5ft., and about 6,000 feet of pipe sewer, varying in size from 12 inches to 24 inches in diameter.

56 catch-basins, 16 manholes, 11 lamp holes and outfall at river.

Certified check for $2,000 to accompany bids.

Council reserves right to reject any or all bids.

Plans and specifications on file in my office.

Frank H. Cooper.

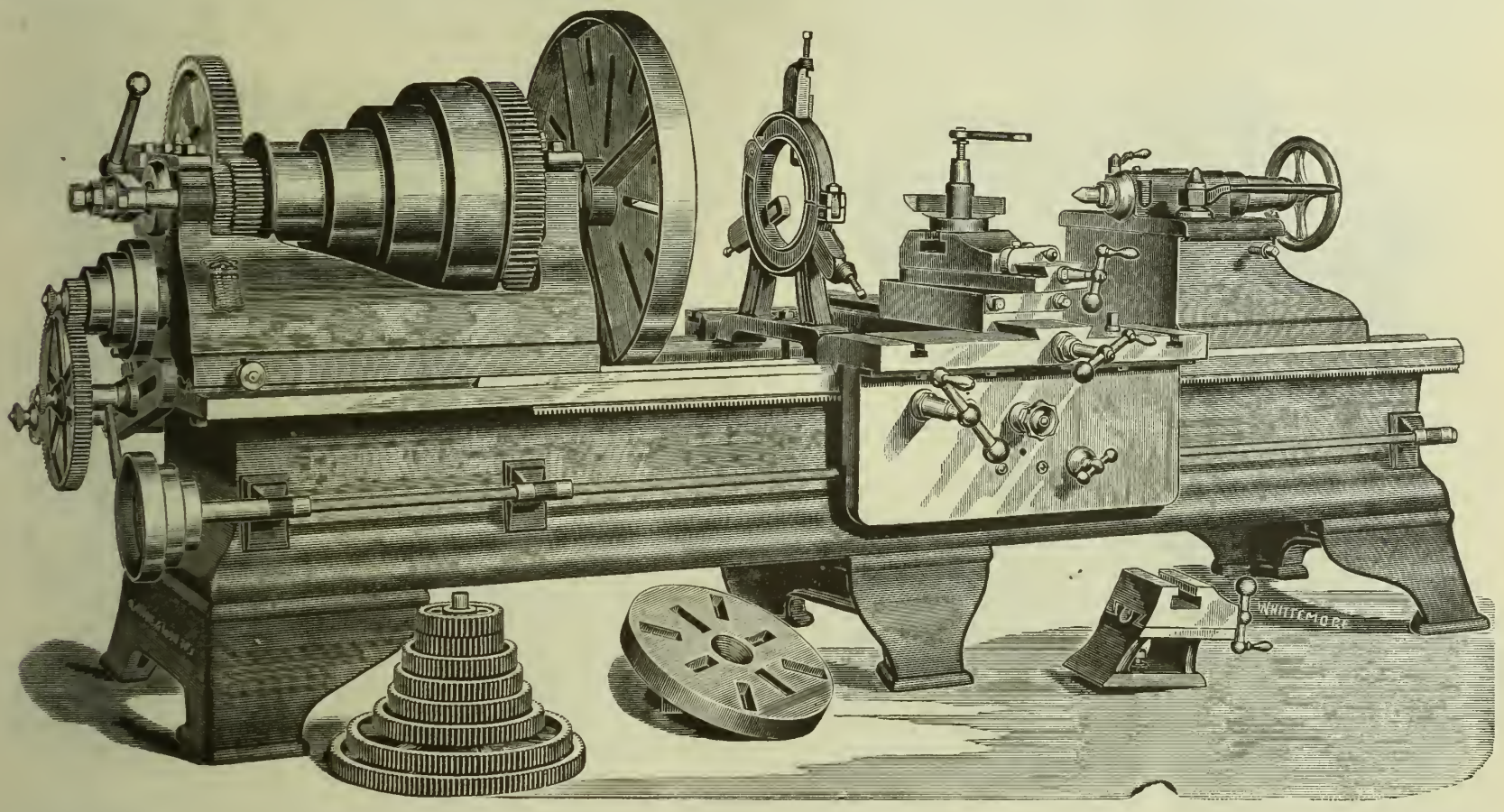
U. S. Court House, Etc., at Denver.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock p. m., on the 8th day of September, 1891, for all the labor and materials required for the joinery work, wood flooring, marble work, vault doors, cement floors, etc, for the U. S. Court House and Post Office, etc., building at Denver, Col., in accordance with the drawings and specifications, copies of which may be had on application at this office or the office of the Superintendent at Denver, Col. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Each proposal must be inclosed in an envelope, sealed and marked, "Proposals for the Joinery Work, Marble Work, etc., for the U. S. Court House and Post Office, etc, building at Denver, Col.," and addressed to W. J. Edbrooke, Supervising Architect.

SEPTEMBER 5, 1891. The American Engineer. VOL. 22, NO. 10.

NEW SCREW-CUTTING ENGINE LATHE.

The accompanying electroplate impression (on this page) represents a thirty-inch swing screw-cutting engine lathe, with compound power cross feed rest, which has been built from new designs and patterns. It has compound power cross feed rest, and is altogether a stiff handsome machine tool. The cones are large, bed extra wide, which in combination with other novel features make this machine very desirable in any shop requiring heavy tools.

This lathe is made in five sizes of beds—10 to 24 feet; turns 5 to 19 feet, and weighs 5,850 pounds to 9,500 ponnds. These lengths of beds may be varied np to and including 25 feet to suit length of shafting required to take in. The speed of counter is 90 turns per minnte; diameter of pulleys on counter, 16x5 inch face. These tools are first class in all particulars and furnished with patent hub friction clntches, which operate without jar or strain, and with ease and certainty, and they are fully guaranteed.



Further particulars may be obtained from the Machinists' Supply Co., Nos. 167 and 169 Lake St., Chicago, who carry these machines, together with a full line of machinists' tools, and will gladly furnish all information possible.

COMBUSTION VS. THE SMOKE NUISANCE.

Some years ago a wealthy manufacturer in the West employing nearly 1,000 hands, established a model city, thns giving the workmen and their families many comforts and luxuries that they could not have attained unaided. Of course there were regulations for the government of the model city, and there were fault-finders; there was one especial fault-finder of the name of Bascomb. Among the rules laid down for the government of the city was one forbidding the burning of soft coal on account of the smoke; to this Bascomb objected strongly.

"My goodness," remonstrated a friend, "I do not see what you are grumbling about, we get hard coal at cost, you ain't out of pocket."

"Tain't no right to forbid it," asserted Bascomb.

"See here," demanded his friend, "do yon want to burn the nasty stuff."

"No, I don't wanter," Bascomb replied, " but I want to have the right in case I wanter."

Yes, Bascomb wanted his rights; every man who now thrusts smoke from his chimney into his neighbor's office, or into the rooms of a hotel, into the very bedroom of his neighbor's wife or daughter, or upon his linen and upon the fine raiment of the ladies that make glad our eyes as we walk the streets, wants his rights: the right to smudge every one within range of their chimneys with smoke, to blind their eyes with grit, to make impure the air that they breathe, with noxious gases; to imperil their property with the sparks they thrust out with smoke and unburnt gases from their chimneys.

The rights of every man should terminate where the rights of every other man begins.

The right of man to breathe pure air is given by God; it is the right of man, rich or poor; to say, you shall not pollute that which the Almighty has made necessary to my very life.

It is not the right of steam-makers, engineers, or manufacturers to contaminate the air with the wasted constituents of the coal that should have been used in their furnaces to make heat. It is not the right of a fireman, an engineer, or other employe, to contemn economy, and exult in self-asserted right to burn their coal as they please, to make as much smoke as they please.

The world owes much to the steam-makers, the engineers and the manufacturers of the world; we are in touch and sympathy with everything that interests them, that affects them, and we propose to stand by them and assert their rights. But there are not a few who, like Bascomb, are unreasoning, opinionated, jealous of their rights, fearful of any one trenching upon their preserves, and not infrequently so stuck up in set ideas that, like the laws of the Medes and Persians, they are unalterable, with set opinions as to matters necessary to them in their calling to know, in which they have not time for study, and about which they will not learn when taught.

There is no industrial nuisance equal to the smoke nuisance. Its growth in every city is proportioned to the enterprise of the capitalists; but capitalists have not had time to study all the conditions necessary to perfect combustion; manufacturers have not the time for such studies and experiments; employes have not the means or opportunities to do all this, hence empirical devices and inventions have been imposed upon them by the thousand, adventurers have floated companies and sold shares, then passed to new fields, abandoning and neglecting the essentials to the successful utilization of the inventions, causing annoyance and disgust to the men who have permitted the use of their boilers and loss to the men who invested their money, making the very words "smoke consumer" a cause for sneering.

Nevertheless, the principles of perfect combustion were long ago demonstrated in the laboratory, and the same is possible in the engineering world; the perfect burning of soft coal will yet be required at the hands of every fireman, and every engineer will be made responsible for the smoke that he permits to pass from his smokestack or chimey; under some conditions of construction they will not be able to prevent the issue of smoke, but the requisites in construction to facilitate perfection in combustion will become the study of every builder and designer in engineering; devices that aid nature in improving the combustion with a view to the prevention of smoke will be a part of every specification; then will the employer have the right to say to his employe, as some may say even now:

"I require to know why there is so much unburnt coal and cinder amongst the ashes."

"I require to know why you make smoke.'

"I require to know why you do not make and keep your steam ready all the time without making smoke."

"I require that you send neither smoke nor grit nor sparks out from that chimney or smokestack."

"If you cannot or will not make and keep steam steady all the time without making smoke and without leaving unburnt coal and cinder in the ash pan, then I will find some one who will."

Prejudice is the womb of injustice, and the many disappointments that have attended everything under the title "smoke consumer" are responsible for prejudice and much delay in getting before the public inventions of real merit; but some of the disappointments have been self-inflicted, or employe-inflicted, by reason of a disposition to kick on account of previous disappointments with inventions into which they lacked the experience to examine before use; or by pure cussedness; or by neglect; or by reason of the men upon whom the use of the contrivance devolved not being pap-fed; therefore it is incumbent upon employers not alone to make sure of the construction of their furnaces, and to bring into use the best appliances for aiding combustion, but to inflict upon their employes the requirements indicated: then will the perfect burning of soft coal without throwing out from the smokestack either soot, smoke, grit or sparks be a *sine qua non* to the employment of both firemen and engineers.

Without such interest taken by builders and designers of boilers, and without such injunctions from employers to employes, the latter as doubting Thomases, or from malice, or from desire to make the payment of boodle a voluntary condition pre-

cedent to the successful introduction of valuable improvements, may effectually bar the way to success or make success most difficult of attainment. There is nothing so good, nor so great as to require 100 men to move it one inch, that one fool cannot destroy.

Engin ers sometimes defy laws enacted for the benefit of the general public, to protect the community from smoke; they sneer at every contrivance for the abatement of the nuisance, and do nothing themselves in mitigation of the dirt they they throw from their smokestacks; some even think it a privilege to be able to make smoke; like Bascomb, they don't want any interference with their rights to make smoke if they want to.

A contrivance was put into one of the finest steamers that sails the lakes, a steamer officered by some of the finest men that sail our inland waters; it was ordered into the steamer by a man who has already made for himself a name to be envied, with prestige from the Mississippi to the Atlantic Ocean as an authority in engineering, more especially in matters pertaining to marine engineering and vessel construction; he is noted for his endless efforts to effect improvements, is unselfish, jealous of no other, anxious to do good always.

The contrivance after a couple of trips of the steamer during which changes were made, demonstrated the practicability of making the combustion of soft coal perfect; the wastes in the ash-pan were confined to white ash and to small cinder that had dropped through the grates before being fully consumed; the smoke from the smokestack was reduce in even the worst of firing to a volume much less than from a like boiler fired at the same time and not equipped with the contrivance, while with good ordinary firing the smokestack was remarkable for its cleanness; indeed one of the firemen showed by his firing during the whole time of his three-hour watch, on one occasion when firing fairly, that the contrivance was effectual in making combustion perfect and in preventing smoke from the smokestack.

The service of the other firemen, when firing as usual and fairly, or to use their own expressive language, not "monkeying," confirmed the results o" service by that other fireman; they all maintaining the steam pressure steadily, without expelling smoke from the smokestack. They shoveled soft coal into the furnaces every six to seven minutes, the frequent firing increasing the liability to make smoke by the frequent supplies from the new coal of volatile matter and by reason of the frequent opening of the furnace doors to put the coal into the furnaces cooling the temperature; but notwithstanding, the resulting effects from the use of the contrivance was bettered combustion, and no smoke from the smokestack.

Notwithstanding the apparent gains from use of the contrivance and the lessened discomfort from the heavy grit and smoke, there were grumblers, jealous of their rights to prevent the use of anything they saw fit, and that jealousy was not wholly within the boat; it extended, like the water in which they floated, to the ships of the company from which they had employment.

As in case of the model city, there were regulations for the direction of the users of the contrivance, and one of the orders was not to touch certain globe valves, that were to be at all times open to secure efficiency, and to give the contrivance natural protection from burning, the globe valves were never to be closed except in case of accident; to keep them open was to give the firemen an advantage in making steam; with the globe valves open the contrivance was in action, improving the combustion and preventing the issue of smoke from the funnel.

But there was a Bascomb about, some one who no doubt "wanted his rights," and Bascombs outside of the ship who were fearful of their "rights;" like Bascomb, they wanted the "right" to make smoke if they wanted to. They would rather have their "rights" than save to their employers the coal they wasted unburnt in the ash pan; they would rather have their "rights" than save to their employers the gases they expelled from the smokestack instead of burning them in their furnaces; they would rather have their "rights" than save to the promenaders on the decks of the beautiful steamers the annoying showers of unburnt coal soot and smoke they thrust from their furnaces through their funnels upon them.

He who was the wiser Bascomb had ordered the contrivance into the vessel, but a Bascomb who could not say nay was still a Bascomb who wanted his "rights," and if he could not say nay, he could close the globe valves, burn the contrivance and have it taken out, why?

"He wanted his rights," and he saw that if only he would but touch the "button" the elements would give him his "rights;" the "button" was accordingly touched, the globe valves were closed, once, twice, three, then four times, and we know not how much oftener; then after doing so, when the contrivance had been abandoned each time to the fire until white with heat, the globe valves were opened, then the contrivance destroyed.

Nobody did it? oh, no! nobody did it! Perhaps it was an angel who watched and did it lest that we should arrive too soon at that millennium state of cleanliness for which our morality at present unfits us? Perhaps it was a mistake? Yes, perhaps it was a mistake? If a stone thrown by an unseen hand strike you, it may be a mistake. If in quick succession another stone thrown by an unseen hand strike you, then you have cause to be suspicious. If there quickly follow another stone thrown by an unseen hand and that strikes you, then will you be alarmed, and fear that some one is aiming at you. If a fourth stone again strikes you, then will you be convinced that some one has designs against you, and you r move to a safer place.

And so it was on that steamer; there was a Bascomb who had designs, a Bascomb who "wanted his rights;" there had been silent grumbling, there had been Bascomb gutturals, Bascomb nerve-twitchings, and sometimes even Bascomb damns, but after the contrivance had been a fourth time touched with the "button," then finished with the globe valve twist, there were Bascomb felicitations; here are some:

Bascomb No. 1—Well, Bascomb, you have done it.

Bascomb No. 2—Yes, it is bursted.

Bascomb No. 1—I am glad of it. Smoke! why, I have no objection to smoke. Smoke! why, I send not only smoke but ed hot flame out of my smokestacks, 8 and 10 feet high.

Stranger—Did you say that you sent red hot flame up out of your smokestack 8 and 10 feet?

Bascomb No. 1—Yes, 15 and 20 feet high; I sometimes have my smokestacks red hot.

Bascomb No. 2—I once had my smokestack red hot and sent red hot flames up from my smokestack 15 feet high, but I got hell for it when it was found out.

Yes, Bascomb wanted his rights, his right to make smoke and red hot flame pass out of his smokestacks to the annoyance of the passengers and loss of his employers.

Fortunately all who feed a furnace, or attend an engine, or buzz about one, are not of the tribe of Bascomb, but all they of that tribe of Ishmaelites require the injunctions of their employers as the *sine qua non* to their employment.

The city of Detroit boasts a man of the name of Mackay* who believes in the *Sun* as the great source of light and heat; he is not a Bascomb, though he "wants his rights;" he saw his chimney give out soot, smoke and noxious gases that hurt the feelings, injured the health, as well as the property of his neighbors, and made the sleepers in the hotels that were near to his place of business very uncomfortable; he wanted his rights, to conduct his business as he pleased, but he concluded that his neighbors had rights too, and he reasoned that he had just as little right to thrust soot, smoke and noxious gases at them as they would have to squirt dirty water at him; the more he reasoned as a reasonable man, the more he felt that his right to

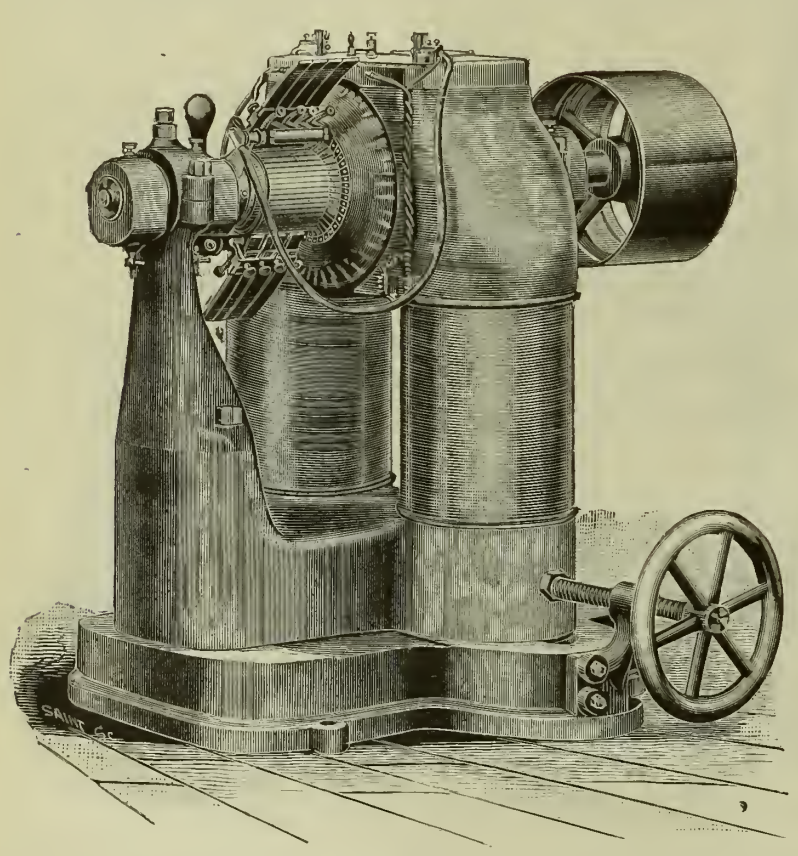


Fig. 1.—Columbia Power Generator.

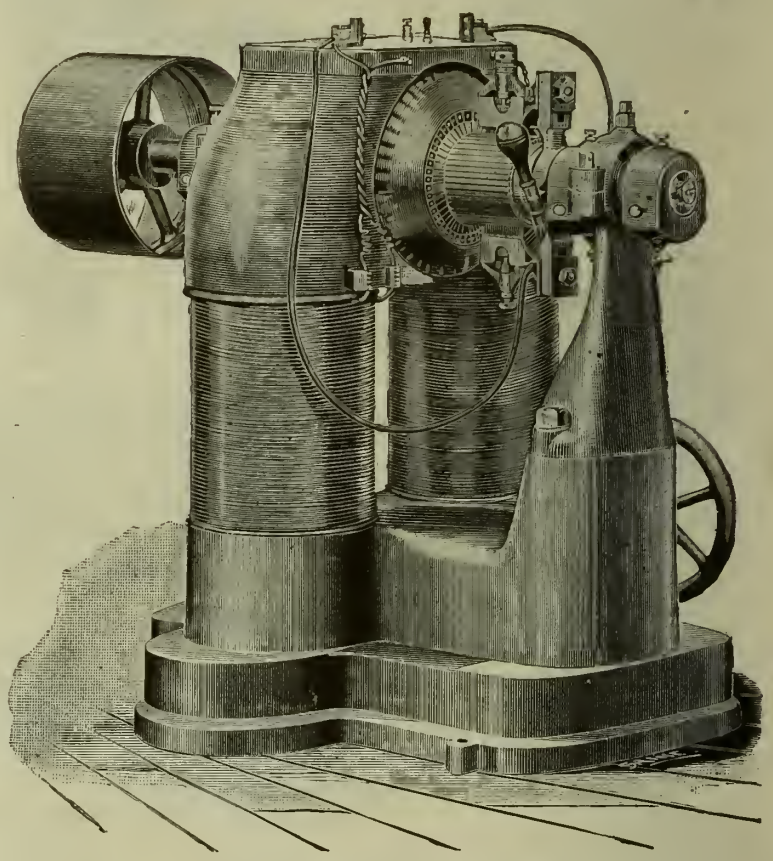


Fig. 2.—Columbia Stationary Motor.

*David P. Mackay, President of the *Sun* Publishing Co., Detroit, Mich.

throw dirty water or noxious gases was bounded by the premises in which he conducted his paper to make light and heat. He argued with himself that the air was the common property of every man; that no court had the power to alienate it, and no government could concede the power to any man to pollnte it; he decided to get from some source, something to aid him in burning his coal upon his grates instead of sending it out as unburnt gases to annoy others in the vicinage of his place of business; he heard of the contrivance, of its trials, and he decided to have it in, as an aid to the *Sun* to make light and heat, then pleased with the result, pleased with the evidence it afforded of his own good and progressively inclined mind, he spontaneonsly gave vent to his feelings, saying: "The *Sun's* smoke preventer a marvel of scientific skill." —*Importer's Record.*

THE COLUMBIA ELECTRIC MACHINES.

The accompanying electro plates represent some of the electric machines made by the Columbia Electric Co., of 207 E. Fourth street, St. Paul, Minn.

Some electrical firms declare they make the best machines—all the rest being nowhere. The Columbia Electric Co. are unusnally modest in this respect. They only claim for their dynamos and motors, eqnality with those of other makers. What they say in reference to this matter is so refreshing that we qnote it:

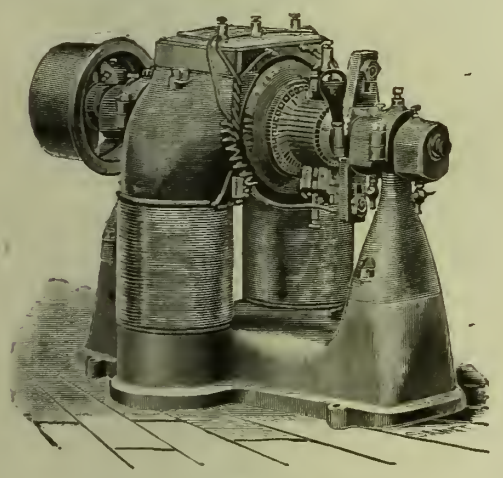


FIG. 3.—COLUMBIA MOTOR.

"The field is filled with other manufacturers, many of whom will resort to the common method of arguing against a competitor's apparatus. We meet all such attacks by guarantees electrically, mechanically and legally, claiming for our apparatus that it is equal in points of merit to any in the market."

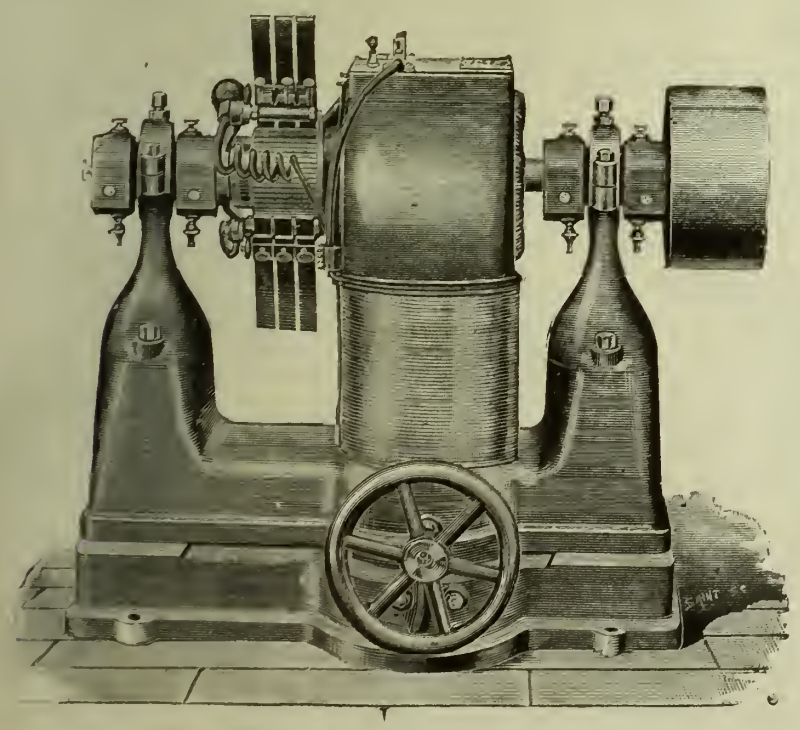


FIG. 4.—COLUMBIA INCANDESCENT DYNAMO.

This company claim, as many others do, that the electric motor is the cheapest and best means of transmitting power, and that, wherever a suitable current can be obtained, no one can find better or as good means for driving printing presses, exhaust and ventilating fans, manufacturing and mining machinery of all kinds, elevators or anything requiring from ⅛ to 100 horse power. They are, as the Columbia and other good companies build them, automatic in action, practically noiseless, free from danger, compact, convenient and require comparatively no repairs.

Inasmuch as all dynamos and motors are based on the same general principles, it is easily understood that the difference in their efficiency must be in the correctness of their design, accuracy of workmanship and quality of materials used in their construction. The aim of the Columbia Electric Company has been to place upon the market a line of motors, dynamos and power generators that will meet all requirements, and their success, they say, is most gratifying. In electrical efficiency and mechanical design they maintain that their mannfacture is second to none.

Fig. 1 shows the Columbia electric power generator; Fig. 2, their large stationary motor. Fig. 3 represents a small Columbia motor. Fig. 4 shows the form and construction of the Columbia incandescent dynamo.

It will be readily seen from the cuts, that the power generators and dynamos are of the same general form as the stationary motors. The magnet cores of each machine are made of the best quality of charcoal wrought iron, giving much higher efficiency than is possible to attain with cast iron cores. The armature cores are thoroughly insulated with pnre asbestos and mica; the same materials being used for insulating the spools upon which the field coils are wound. The commutators are insulated entirely with mica, and are so constructed, it is said, that it is impossible for the bars to become loose.

And by reference to the accompanying illustrations, it will be seen that the Columbia dynamos, motors and generators are provided with self-oiling bearings and self-aligning journals; and in large sizes they have a perfect belt tightening device. Carbon brushes are employed on all the motors when wound for 220 volts or over; and, when so ordered, may be run in either direction or reversed at will. The carbon brush-holder is extremely simple, and is so constructed that a uniform pressure of the brushes against the commutator may be maintained until the brush is entirely worn out. Motors over 5-horse-power have sub-bases and screw, for belt tightening.

The Columbia Electric Co. manufacture motors from one to 50 h. p.; power generators from 25 to 100 h. p.; and dynamos from 25 to 500 sixteen candle power lamps capacity. And they wind machines for any standard potential required. They also manufacture all necessary parts and instruments to make a working electric plant complete, such as cut-outs, switches, rheostats, volt meters, ammeters, lightning arresters, key and keyless sockets, lamps, fixtures, shades, etc. Their shunt machines and motors are provided with indestructible rheostats. And the aim of this company seems to be to supply the best machines and appurtenances they can possibly make.

Those who contemplate the installation of electric plants would do well to put the Columbia on the list of companies to consult.

A MARVELOUS ELECTRIC RAILWAY RECORD.

One of the most remarkable Electric Railway repair accounts which has ever come to our notice, is that of the Rochester Railway Company of Rochester, N. Y., covering the eight months ending July 1, 1891.

This company in the spring of 1890, placed a contract for 100 cars and 900 horse power in generating capacity, with the Short Electric Railway Company of Cleveland, Ohio. The motors were of the "Double Reduction" type, which has become so well known throughout the country and the cars were of the heavy, vestibule type, built by the Gilbert Car Company. The road was gradually equipped, first commencing operation in November 1890, with but six cars and increasing from time to time as the line construction was completed.

The Short company is one of the very first to keep a separate account of repairs on all their electrical machinery. In their "Car Record Book," one page per month is devoted to each car, on this page being entered (1) the daily mileage, (2) the hours of labor chargeable directly to a particular car, (3) the cost of said labor.

This company also keeps a "General Expense Account," in which is entered all the labor on repairs to electrical machinery not directly chargeable to particular cars, and a "Material Account," for all material used in such repairs. A summary of these two accounts is entered in the "Car Record Book" at the end of each month.

It appears from the mileage records that 70 cars are reported upon as being in operation at one time and another during the eight months. The total mileage is 753,250.

In the practical operation of a railroad, whether steam, cable, horse or electric, there are always cars out of service on account of repairs. It is usual to provide spare apparatus to take the place of that temporarily disabled. The smaller the amount of dead capital necessarily so invested, the more satisfactory is the sytem of motive power. It is important to know therefore, what proportion of the Rochester cars have been out of service on account of repairs. This can be easily obtained from the Official Records. The calculation has been made by adding 50 per cent to the time actually spent in repairs and multiplying the result by the average schedule mileage of the road. The results are very remarkable. 3 cars have lost no mileage; 16 cars have lost less than 100 miles each, averaging 32½; 23 cars have lost between 100 and 500 miles, averaging 260; 15 cars have lost between 300 and 1,000 miles, averaging 695; and 9 cars have lost over 1,000 miles, averaging 1,371.

The average mileage lost per car has been 425; and the mileage lost is but 4 per cent. of the total mileage.

This is a most wonderful record, and it will be hard to find its parallel in any other existing electric or steam railway, it is claimed. Some idea of it may be obtained from the consideration that in horse railway practice it is usual to provide 10 per cent. reserve in horses and from 5 per cent. to 10 per cent. in cars.

Again, it appears that out of every five cars drawn in for repairs, three are on account of motor troubles (chiefly mechanical) and two are on account of car bodies and trucks. That a comparatively simple truck, should cause nearly as much trouble as a complicated motor, is surely worthy of note.

But it is in the cost of repairs that the true meaning of the records quoted is clearly seen.

From these records it appears that in the eight months 3 cars have cost nothing for repairs; 33 cars have cost less than $5.00 each, averaging $2.49; 16 cars have cost between $5 and $10, averaging $6.90; 3 cars have cost between $10 and $15, averaging $12.92; 7 cars have cost between $15 and $20, averaging $17.05; 2 cars have cost between $20 and $25, averaging $22.02; 4 cars have cost between $25 and $30, averaging $27.11, and 3 cars have cost over $30, averaging $36.72.

The average of the repairs properly chargeable to cars is $8.97 or $.0009 per car mile. The cost of material is $21.46 per car or $.0022. This account includes quite a large amount of material on hand, not yet used, all of which goes into the report The cost of "General Expenses" was $9.43 per car or $.001 per car mile. This brings the total repairs to $39.86 per car, or four mills ($.004) per car mile.

The Short Electric Railway Company is certainly to be congratulated upon its wonderful record at Rochester, and the Rochester Railway Company may safely assume that it is operating one of the finest and most successful electric railways in the world.

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TO WHOM IT MAY CONCE.

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JEFFERSON YOUNG, JR.
Supreme Chief Engineer A. O. of S. E.

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CONTENTS OF THIS NUMBER.

ARTICLES:

BRITISH BOILER EXPLOSIONS AGAIN.

Americans are blamed by foreigners for assuming too much. We have not yet heard of a boiler being examined by a man who knew nothing whatever about a boiler, and that examination being accepted by the owner. In another part of this issue we present a report (from *Engineering*) showing that a boiler was "examined" in all seriousness in England, (and at Coventry of all other places, through which Falstaff would not march his lean soldiers) by a man who worked in a cycle factory, and "do little jobs." The owners of the bursted boiler (over which the inquest herein reported was held) paid this man-Deakin, by name-"to instruct their engineer," as well as doing odd jobs about the place.

Another bursted boiler was in charge of the owner's son. The young man had "not had any previous experience with boilers." But the most ridiculous "engineer" connected with the three explosions herein reported is James Wright, a corn miller, who never had any experience with boilers until he bought a worn out old thing that was only fit for the scrap heap. He undertook to run it himself. "He had had an engine driver to instruct him when he first had the boiler, and another man sometimes ran in to advise him two or three times a day."

If there is any case of recklessness, in handling steam boilers, in all America, beating that record, we have yet to hear of it. We very much doubt if it can be equalled anywhere. The average of British "engine drivers" would find it hard to have a chance to run an engine even in the most obscure saw-mill in the United States.

This is not mentioned by way of brag. But it is some satisfaction to know that, as a class, American steam engineers are far ahead of their fellow craftsmen across the water. Yet there is much room for improvement. And the American Order of Steam Engineers, and others, should not relax their efforts in securing licensing laws and enforcing their faithful administration when such laws are enacted.

BUILDING THE COLUMBIAN EXPOSITION.

It takes a fence six miles long to enclose the World's Fair buildings. All these structures are to be of extraordinary dimensions, but the largest of them, on which the foundation work has just been commenced, will be something stupendous. It is the Hall of Manufactures and Liberal Arts. The site for this vast building is a broad, highly situated plateau overlooking the lake. A railroad track runs through its center, and on each side rise tremendous piles of lumber, iron and all sorts of construction material.

A similar scene is witnessed at the other great buildings, on which further progress has been made. Within the enclosure the Exposition site resembles one vast work-ground, surrounded by freight cars and lumber yards. Looking out towards the lake, the breakwater, the long pier and foundation for the naval exhibit present the appearance of a mammoth dockyard.

Changed, indeed, is Jackson Park, and those who visited it three months ago would not know it now. A world's workshop, employing an army of builders, environed on three sides by the foliage and flowers of the south parks, and on the fourth by the infinite expanse of the lake.

The exposition site has undergone a wonderful change since last spring. Then it was a soft marshy ground shelving in irregular stretches to the water line. Now it is a firm level, a smooth sandy surface upon a clay subsoil. A perfect and admirably improved building site. The hundreds of visitors who view the grounds cannot immediately appreciate the immense difficulties that have been overcome and the great labor involved in the earthwork accomplished on this lake shore site. It is now a level surface to the line of the lake, a surface a mile and a half in length and, at its southern extremity, nearly a mile in width. This has been created, graded and leveled by constantly employing a small army of men and now, within the six miles of fence that surrounds it, the work of constructing the great buildings is being pushed with ceaseless activity.

From the slight eminence already known as "administration hill," which the lofty administration building is destined to effectively crown, the observer can even thus early gain a realistic sense of the distinctive features and general magnitude of this stupendous undertaking. At this point he is practically in the center of the sites allotted to the principal buildings and the system of terrace work which will surround them. He is also in the center of a complex network of railway track, 50,000 feet of it extending in every direction and connected with the trunk lines by fifty switches, all of them in constant use. This system of railway is laid upon what, four months ago, was wild park land untouched by the first improvement. The tracks are covered with cars, loaded with lumber, iron and every description of building materials. These roll into the grounds unceasingly and are switched up to the buildings to which the materials belong. Gangs of men take hold with a will and as if by magic towering piles of material rise in every section of the grounds. Mounted superintendents ride from point to point urging things forward. The word is "rush" in every department and branch of construction.

The big buildings are beginning to rise. Already some of the principal structures are not only in evidence, but progress on them is marked from day to day. Looking northwest from the administration building the visitor sees the Womans' Building, already so far advanced that it looms up imposingly against its back ground of park trees.

Rising in the vista are the Electricity and Mines and Mining buildings, on which the foundations are already completed. Upon the sites of the Horticultural and Transportation buildings all preliminary work is completed, and hundreds of tons of material are already to be placed in position.

Hundreds of men are engaged on every possible sort of construction work. Laying water-mains, electric-light plant, modeling for the exterior decorative work and developing landscape effects around the ornamental waters.

A busy place indeed is the exposition ground, and soon it will be as busy by night as by day for the electric lighting necessary for night construction has just been arranged for.

From one end of the grounds to the other everything is pushed, and that, too, in all sections of the work. In the landscape system, which includes the lagoons, basins and ornamental waters, the breakwater and lake shore terrace, the great pier and casino; in fact, all principal departments and even their minor divisions are being pressed forward with a business-like ambition thoroughly in accordance with the impelling spirit of this gigantic enterprize.

TELEPHONE RENTALS.

"Boycotting the Bell" is the caption of an article in *Electrical Enterprise*, showing that the rentals of telephones in Baltimore, Md., are likely to be reduced. It says:

A gentleman who gave considerable attention to the subject of telephone charges in reply to statements of the telephone company had made the following apt remark:

"President Byran of the Chesapeake and Potomac Telephone Company says that the lowest price at which approved telephone service can be supplied in a city of the size of Baltimore is $100, but it does not say, what is a fact, that cities and towns of much smaller size have approved services at a much lower rate.

"It does not seem reasonable to me, nor do I believe that, upon reflection, it will appear reasonable to President Bryan that small rural cities that have only 100 to500 telephone subscribers can be supplied with an approved service at a less proportionate expense than Baltimore with over 2,000 subscribers. Still the Baltimore druggists are told that $125 per annum for an unrestricted telephone service is a very low price. In Indianapolis and in the whole State of Indiana, in fact, the price is $60. In Montreal it is only $50. In Lutherville, Md., the Baltimore Exchange sub-leases the instruments for $36 a year and they are rented out to subscribers at $80 a day. [A year.]

"But now let us ask the telephone company what is meant by an approved service. President Bryan says it is entirely reasonable for us to ask for better instruments, and better service, and that by August 10, the company will be in a position to furnish and will furnish the best telephone service, and the most expensive and approved apparatus. Will his company furnish the best and most approved instruments similar to those in use in St. Louis for instance? In St. Louis all that is required there is for the subscriber to press a button quickly, put the hand piece to his ear and (without stopping to 'hello' to the operator or have 'hello' back), quickly pronounce two numbers, his own and the one wanted. A connection is made at once. If the line is in use, instead of the operator telling him of the fact, she merely signals it back on the bell. You press the button, quickly, breathe the number and she does the rest."

Simultaneously comes the *Electrical Engineer* (London) with the following statement:

"The Western Counties and South Wales Telephone Company announce important reductions in rentals and an increase of area at the reduced rates for connection to their local telephone exchange systems commencing September 1. Each business or professional connection for lines within one mile radius of the Company's exchange will be charged the following rates: £9 per annum on seven years' agreement; £10 per annum on four years, and £11 for a yearly agreement. Private residences, without business or professional practice, may now be connected to the exchange at rentals varying from £5 to £8 per annum according to distance, not

exceeding one mile, from the nearest exchange. Another important feature in connection with the company's rates is that there will be in future no further liability on the part of the renter, as the charges are inclusive of the cost of construction of the lines, erection of instruments, and maintenance of the whole in proper working condition. The directors are prepared to convert the unexpired period of existing subscribers' agreements to the new rates for either of the three periods, provided that the period is not less than that remaining unexpired on the existing contract."

BOILER EXPLOSIONS AT ST. ALBANS, SAFFRON WALDEN AND COVENTRY.

Three formal investigations have just been conducted by the Board of Trade Commissioners with regard to the circumstances and cause of boiler explosions at St. Albans, Saffron Walden and Coventry. The particulars are as follows:

The first of these investigations was held at the town hall, St. Albans, and dealt with an explosion which occurred on Monday, May 11th, at the straw hat manufactory of Mr. T. H. Johnson. The boiler was of the semi-cylindrical, vertical, internally-fired type, semi-circular at the back and flat at the front. It was welded at all the seams except at the the attachment to the shell crown, which was riveted. Its height was 4 ft. and its diameter 2 ft. 4 in. from front to back, while the width was 2 ft. 11 in. The firebox and uptake were both 2 ft. high, the inside diameter of the uptake being 6½ in. The plates were of Robert Heath's Staffordshire B B iron, ⅜ in. thick throughout. There were two mudholes in the water space below the firedoor, and one above the firedoor. The flat front plate was strengthened by an angle iron bent to the shape of a V, and secured to the shell sides and front by two rivets in each case. The firebox and shell were strengthened at each side by two ⅞ in. screwed and rivetted stays. The boiler was fitted with an open lever safety valve $^{13}/_{16}$ in. in diameter, loaded by a lever and weight, and was supposed to blow off at 25 lb, but the pressure had been seen as high as 40 lb. The lever could not be found after the explosion. The safety valve and steam pipe were on the same outlet, and on a previous occasion the valve had been found choked with scum carried up by the outflowing steam.

Failure occurred at the welded seam bordering the top of the firedoor, the rent extending to all the welded seams of the shell, and ultimately tearing the boiler into five fragments. The semi-circular portion of the shell, together with the crown and uptake, were blown backwards, and in an upward direction, demolishing the outer wall of the manufactory, which consequently collapsed. The flat front plate was blown forwards with the firebox portion.

As will be seen from our report of the official inquiry, the Commissioners found that the cause of the explosion was shortness of water, coupled with excessive pressure. While, however, there is strong evidence of over-pressure and weakness of construction, as shown by the bulging of the flat plate at the front, above the firedoor, the fact that the firebox was the only part of the boiler not materially injured, does not seem to warrant the conclusion as to the water supply having been allowed to run short.

The boiler was made in 1884. When new it was tested by hydraulic pressure to 80 lb., and was intended to work at 25 lb. No repairs had been effected since it had been fixed at Mr. Johnson's works. Mr. Johnson, Jun., had charge of the boiler, but left the firing to one of the workmen. From time to time he tested the water- gauge, and would tell the Court that occasionally he found the thoroughfare choked with indla-rubber packing, and also with sediment from the feed supply. On the morning of May 11 the boiler was working satisfactorily, and shortly before 1 o'clock the attendant saw that the water in the glass was about 1 in. from the top and the pressure on the steam gauge about 5 lb. He threw several shovelfuls of coal on to the fire and went to dinner.

It did not appear that any one remained in the vicinity of the boiler after 1 o'clock. About 2 o'clock the boiler burst, burying Mr. Johnson (the owner) and his wife in the ruins of the building and inflicting serious injuries upon them.

Mr. Balmforth, welded boiler maker, Luton, said he made the boiler and sold it to Mr. Johnson in 1884, the price being £25. He had made similar boilers for other people. The safety valve possibly was not quite large enough. He thought that to weld boilers was a satisfactory method of construction. He had known welded seams to leak, but the cause was, he thought, not due to the strain to which the boiler was subjected, but to imperfect welding. It was the custom of his firm to inform customers that the boilers could not be worked at a high pressure.

Mr. Johnson, Jun., the "engineer," had not had any previous experience with boilers. The feed water was obtained direct from the water company's main; it was very hard, and there was generally considerable deposit in the boiler. He once saw the pressure gauge indicate 40 lb., and about three months before the explosion he took the safety valve to pieces because scum had risen on the surface of the water, and set the valve fast in its seat. He had also found the water gauge choked. When he left the boiler on the morning of the explosion everything was right.

Henry Ward, an employe at the hat works, said he attended the boiler and the feed supply. He generally worked at 25 lb. to 30 lb.; the highest pressure he had seen on the gauge was 35 lb. He fed the boiler just before dinner on the morning of the explosion, and also put some coal on to the fire, but did not notice the pressure at the time.

Mr. Askew, assistant engineer to the St. Albans Water Company, gave particulars as to the pressure of water on May 11, and added that he did not know the boiler was connected with the company's mains, for that was a practice they disapproved of and did not allow.

Mr. Rowe, engineer-surveyor to the Board of Trade, gave a report of the result of his examination of the boiler. The cause of the explosion he considered was over-heating and over-pressure.

After an adjournment, during which the boiler was inspected by the Commissioners, Mr. Gough (counsel for the Board of Trade) submitted the following questions to the Court, and asked for judgment thereon:

1. Whether the boiler was properly constructed, and whether the mountings were sufficient, especially having regard to the fact that the seams were welded, that one outlet was common to the safety valve and stop valve, and to the relative size of the safety valve and grate area?

2. Whether the safety valve was so arranged that the pressure in the boiler could not exceed that for which it was constructed?

3. Whether the arrangement for feeding the boiler was a proper one, and whether the feed check valve was properly examined from time to time?

4. Whether proper measures were taken by the owner and his son for the efficient management of this boiler?

5. Whether on the morning of May 11 last the water gauge cocks and safety valves were in good proper working order?

6. What was the cause of the explosion?

7. Whether blame attaches to Mr. Johnson, Sen., Mr. Johnson, Jun., and to Mr. Balmforth, the maker of the boiler, all or either of those gentlemen?

Mr. Commissioner Smith, in giving the decision of the Court, said that they considered negligence had been shown by Mr. Johnson, Sen., in the management of the boiler, and also by his son, who should not have taken charge of it when he did not understand how to do so. With regard to Mr. Balmforth, although he was perhaps not to blame, yet the Commissioners hoped that in the future manufacture of these welded boilers he would explain to his customers that they were to be worked only at low-pressure. A properly qualified engineer should have been left in charge of the boiler when the regular attendant was away at dinner. The Court was of opinion that the water-gauge taps and the safety valve were fast, and that the explosion was due to over-heating and over-pressure. Considering the financial loss and personal injury which Mr. Johnson, Sen., had sustained, the Commissioners would not make an order upon him as to costs.

The second formal investigation was held at Saffron Walden, and had reference to an explosion which occurred on Thursday, June 18, at Mount Pleasant-road Corn Mill, owned by Mr. James Wright.

From Mr. Gough's opening statement it transpired that the boiler was of the portable locomotive type, made by Messrs. Tuxford in 1857. Its history between 1857 and 1877 could not be traced, but in the latter year it was sold by auction to a Mr. Partridge, of Soham, Norfolk, who worked it for some time, but the pressure could not be ascertained. When Mr. Partridge purchased the boiler it was examined to some extent by Messrs. Holmes, engineers, Norwich, and slight repairs were made. In 1883 it was subjected to a general overhaul by the same firm, and some new plates were inserted, after which it was tested, and in the opinion of Messrs. Holmes was fit for a working pressure of about 60 lb. on the square inch. In December, 1884, Messrs. Burrell and Sons, of Thetford, supplied a new boiler to Mr. Partridge, and took the old one in exchange, allowing 30*l.* for the boiler and engine combined. Messrs. Burrell, after making some small repairs to the ashpan, painted the boiler, and in April, 1885, sold it to a Mr. Maynard, engineer, Whittlesea, for the sum of 38*l.* 10s. Mr. Maynard worked it for a time at 40 lb. pressure, and so far as could be ascertained no repairs were effected while it was in his possession. In November, 1888, he purchased a new boiler and sold the old one for 2*l.* to a Mr. Chapman, an engineer in his employ. The new purchaser did not examine the boiler or repair it, but advertised it for sale for the sum of 15*l.* Mr. Freestone, an engineer living in the locality, pointed the advertisement out to Mr. Wright, who thereupon bought the boiler for 10*l.*

Mr. Commissioner Smith: Mr. Chapman, therefore, made a very good profit—500*l.* per cent.

Mr. Gough, continuing, said that Mr. Wright on buying the boiler did not ask Mr. Freestone or any one else to examine it, but set it to work early in 1889 at a pressure of 40 lb. to 45 lb. Mr. Freestone soon afterwards repaired the engine, but did not examine the boiler. At Christmas last, as leakage was going on, he was called in to attend thereto. The leakage was at the bottom of the firebox at the front, and Mr. Freestone corrected it by inserting a leaden rivet. In February the boiler ceased work for the winter, and lay idle till June 17, though it was kept full of water. On June 17 steam was got up to 15 lb., and the next morning the fire was again lit, and the engine started about 5 o'clock. At that time Mr. Wright tried the water gauge, which was clear, there being then about 3 in. of water in the glass, and the pressure gauge registering 35 lb. to 45 lb. The gauge, however, was 10 lb. fast. About a quarter of an hour afterwards the boiler burst, rending in the firebox, but fortunately without inflicting any serious personal injury on Mr. Wright or his assistant, who were close by at the time.

Mr. William Towell, formerly engaged as foreman with Messrs. Tuxford, deposed to the construction of the boiler by that firm, and gave a general description of it.

Mr. Fred Holmes, partner in the firm of Holmes and Son, Norwich, stated that in April, 1883, the boiler was sent to their works, and was re-tubed and repaired at a cost of about 41*l.*, after which it was tested by steam to see that all was satisfactory. He then considered it was safe to work at 60 lb.

Mr. Robert Maynard, engineer and iron and brass founder, said he bought the boiler from Messrs. Burrell in April, 1885, but made no examination beyond taking a general view. He worked it for a year or two and then, as the engine was not suitable, he put down a new boiler. The old one being in the way he sold it in 1888 for 2*l.* to Reuben Chapman, but it was worth more than that as old iron if any one would have gone to the expense of breaking it up. He did not know whether the boiler was worn out, as, personally, he had nothing to do with it, and never made any examination.

Reuben Chapman, who informed the Commissioners that he was a blacksmith and engineer, said he had worked eight years for the last witness, and had examined boilers by "pumping cold water into them and getting up steam afterwards." He gave Mr. Maynard 2*l.* for the boiler and then advertised it for sale at 15*l.*, or in exchange for a cow or some pigs.

He purchased it as a going concern, but for old iron it was worth 3*l*. 10s. Subsequently he sold it to Mr. Wright, who saw it at work, the steam gauge at the time showing 45 lb., though the gauge might not be accurate. He did not remember telling Mr. Wright that the boiler and engine would do a lot of work without any repairs, though he certainly led him to believe that they were both in good working condition, and that he was getting a bargain. While the boiler was in Mr. Maynard's possession witness put a small patch on the left-hand side of the fire-box.

Mr. James Wright deposed to being a corn miller and to having had no experience with boilers until he bought the one in question. He purchased it to drive the mill when there was no wind. He inquired of Chapman whether any repairs were necessary before working it, and he replied no, and that if he were going to keep it himself he should work it as it was. Mr. Freestone had repaired the boiler when it leaked, but witness did not ask him to examine it nor did Mr. Freestone suggest an examination, though he might possibly have said he did not think much of the boiler. He wanted the boiler repaired so that it should last the summer, and then he intended having it overhauled. He had had an engine driver to instruct him when he first had the boiler, and another man sometimes ran across to his mill to advise him two or three times a day. During the whole time he had had the boiler not a single person had said anything to him to lead him to think that there was any danger in its use.

Mr. William Woodthrope, engineer-surveyor to the Board of Trade, said that the crown of the fire-box was wasted by corrosion to a thickness varying from $\frac{1}{8}$ in. at the strongest part to that of paper along the line of fracture, so that it was quite unfit to stand the pressure of 40 lb. or 45 lb. at which the boiler was worked.

Mr. Commissioner Smith delivered judgment. He reviewed the facts respecting the construction of the boiler, and its history up to the day of explosion, and expressed the opinion of the Court that Mr. Maynard had been guilty of grave negligence in working the boiler for nearly three years without an examination. Even if he had sold it to Chapman with the idea that it was going to be broken up, it would have been better if he had seen it broken up. His conduct was reprehensible. Mr. Freestone ought to have told Mr. Wright in no uncertain terms that the boiler was not in a fit state for work, and his conduct too was somewhat reprehensible. The Commissioners were of opinion that Chapman did make representations as to the condition of the boiler which led Mr. Wright to believe that it was safe to work it, and for making these representations he was very much to blame. With regard to Mr. Wright, the Court came to the conclusion that he too was to blame. No doubt something was to be said on his behalf, but if he chose, for the purpose of his trade, to use steam appliances, he must take care that they were worked in safe condition, and if he could not manage them himself, he should have employed a person who was competent to do so. When he bought the boiler he should have had it examined. Although he was more sinned against than sinning, they must make an order upon him for £10 towards the costs, and at the same time would express the hope that the Board of Trade would give him a reasonable time in which to pay it. As to Chapman, he would have to pay 5*l*. towards the expenses, and even then he would be 2*l*. 10s. in pocket, considering that he had made 7*l*. 10s. out of the boiler when he sold it to Mr. Wright.

The third formal investigation to which we may refer was held at Coventry, respecting an explosion which took place on Friday, July 3, at the malleable iron works of Messrs. Floyd and Floyd.

The boiler was of plain, cylindrical, externally-fired construction, flat at the front end, and cambered at the back. It was 23 ft. long, 3 ft. 2 in. in diameter, made of plates $\frac{5}{16}$ in. thick, and stated to be worked at 30 lb. pressure.

The shell rent longitudinally at the side in the last plate, the rent extended round the boiler circumferentially in an irregular line, and also through the rivets of the back end seam. The last belt of plating thus detached both from the end and from the main portion of the shell, was torn into two pieces, which were blown backward a short distance, while the back end plate was blown through, and over, the works, and deposited in a garden sixty yards distant. The premises were almost entirely demolished, and seven persons injured.

Though the explosion produced great havoc the cause was extremely simple, and one which, as we have repeatedly pointed out in similar cases, could readily have been prevented had the boiler been carefully examined. The plates were almost wasted away by external corrosion, so that they were unfit to sustain even the comparatively low pressure of 30 lb.

Mr. Gough, in opening the case for the Board of Trade, informed the Commissioners that the boiler was made by Mr. Smith, of Bedworth, in 1881, and was then tested to 70 lb. It was made to the order of Messrs. Starley Brothers, who then leased the works. In 1885 Messrs. Starley removed and left the boiler standing idle and empty until September, 1887, when Messrs. Floyd took possession. They called in a man named Arthur Deakin to make an inspection. A portion of the boiler was exposed to the weather, and during rain a certain quantity of water found its way on to the brickwork in which it was built. The boiler was not insured, nor had it been examined by any one, with the exception of Deakin, who made inspections from time to time down to Easter, 1890, and though he knew the boiler was exposed to damp he never suggested to the owners that the brickwork should be taken down, nor did he even remove the composition which covered the shell crown in order to examine the plates. The boiler was used for six hours a day at a pressure of 25 lb. to 30 lb. At about 8 o'clock on the morning of July 3, the attendant noticed that the pressure gauge indicated 25 lb., and after opening the firedoor he went to another part of the works, when almost immediately the explosion occurred, and he was rendered unconscious. Six other persons were more or less injured, but fortunately there was no loss of life.

Evidence was given by the boilermaker and by Mr. Starley, the original owner, after which Mr. E. A. Floyd gave particulars as to the purchase of the boiler and the price. Mr. Deakin, he said, was employed to overhaul it and to put it in working order, but he could not tell what sort of an examination he made or what condition he reported it to be in, but his firm would not have kept it in work had not the report been satisfactory. Deakin continued to examine the boiler at intervals, say four or five times a year. His reports were verbal and were always satisfactory. One of the firm's annealers cleaned the boiler out every six weeks, but never reported any defects. Witness did not know how old the boiler was, or that it was subject to dampness externally, either from rain or from leakage at the safety valve. The brickwork was never ordered to be taken down or the composition to be removed. They thought the boiler was all right and that it would stand three times the pressure put upon it.

Mr. Commissioner Smith inquired whether witness had ever heard that boiler explosions had occurred which were due to external corrosion, and on witness replying that he had not heard of such cases, Mr. Smith expressed his surprise.

Mr. Arthur Deakin, who said he was a fitter by trade and was now working in a cycle factory, deposed to having examined the boiler up to Easter, 1890. In 1887 he was inside it, and there was no sign of damp about the brickwork. He sounded the plates, and found one which was defective.

By the Commissioner: He was not apprenticed to a boilermaker, and was never brought up to the trade. He did not consider it necessary to remove the brickwork so as to examine the plates. He thought once in ten years often enough to take the brickwork away for that purpose, but had never suggested to Messrs. Floyd that this should be done. The firm paid him to instruct their engineer as well as to do any little jobs that were wanted, and "the examination of the boiler was lumped in with any job." He had not suggested that any one else should be called in to make an inspection. He had only examined one other boiler beside this.

After some unimportant evidence by other witnesses, Mr. Woodthorpe, engineer-surveyor of the Board of Trade, said that the plates at the back end of the boiler where in contact with the brickwork were almost completely eaten away by external corrosion, which had probably been going on ever since the boiler was first laid down. The brickwork covering of a boiler should be occasionally removed, certainly oftener than once in ten years. In some cases ten months might be too long.

Mr. Howard Smith gave judgment. So far, he said, as the Court could ascertain, no proper examination had ever been made, and they considered that owing to the boiler having been exposed to the weather it was very important that it should have been examined at regular periods. It was clear that Mr. Deakin had not sufficient knowledge to make a proper inspection of any boiler, for he had had no experience, as he had only examined one boiler during his lifetime. The Court considered he was to blame for taking upon himself a duty which he was incompetent to perform. For ten years the boiler had been exposed more or less to deterioration. Messrs. Floyd did not employ a competent person to examine it, but allowed it to be used without proper inspection, which was a very reckless proceeding. Many cases of explosion due to external corrosion had come to the knowledge of the Court, and it was the duty of people who used boilers to see that the plates were in good condition where covered by brickwork. The boiler had been very much neglected, and Mr. E. A. Floyd had been reckless and careless with regard to it. He was therefore to blame for the explosion. The Court would make no order against Mr. Deakin. More than a year had passed since he last examined the boiler, and they thought he was entitled to escape. With regard to Mr. Floyd, they had taken all the points he had urged into account. He had lost money by the explosion, and had provided for the injured employes during the time they were laid aside. Therefore, in the opinion of the Court, the justice of the case would be met by his paying the sum of 25*l*. to the solicitor of the Board of Trade towards the costs of the investigation.

FLANGING AND WELDING BOILER STEEL.

Can boiler steel be satisfactorily welded? Is any test applied on the individual weld? Has the weld to bear tension when the boiler is at work? In answering these, experience over the many hundreds of shell welds that have been made in 200 steel boilers shows that with ordinary care an ordinarily good workman can make a sound weld by using a best Yorkshire iron glut, and we have never had a single weld show leakage. Perhaps the very best test of all that could be applied under the circumstances is applied to each individual weld, viz., the weld being made before the plate is flanged, has to stand the subsequent flanging in the hydraulic press, and it seems certain that if it were a mere surface weld it would divide when the disturbance caused by the flanger came upon it. With regard to tensional stresses, the writer wishes to be very emphatic in disclaiming any application of the tensional stresses of the boiler shell to the weld. The butt straps extend to the very edge of the curve of the flange, and the flange itself represents an extra amount of shell material given in beyond what is required to sustain the stresses due to the length of the boiler. Even this flange is also in the condition of having a strap passing over the weld, for the end plate forms a good practical strap to the flange. To put the matter another way, the flange of the shell forms a kind of strengthening bead at the edge of the plate, adding considerable to its strength, and greatly reducing liability to rupture from the edge. The weld, therefore, is only exposed from beneath the straps at the curve of the flange, where, from the form of the plate, it is very strong, and where practically it has nothing to do but secure steam tightness. An eminent engineer, whose views on practical matters are greatly valued by this institution and the profession at large, remarked, in his usual original way, on seeing one of these boilers:—"Suppose you saw-cut the weld through at the part where it is exposed, what would happen? The boiler would not burst, for the stresses are securely carried by the straps. All that could happen would be leakage."

Will heavy boiler steel satisfactorily stand flanging to a right angle? Does the necessary local heating seriously injure the plate? Are the plates an-

nealed after flanging? The writer is of opinion that if boiler steel cannot be flanged at right angles with a fairly large radius in the corner when red hot, without injury, it is not fit to build boilers with at all, and since he has now flanged about 1,000 large thick shell plates without returning to the makers more than two plates which showed slight surface tearings on being flanged, he has no hesitation in saying that ordinarily good mild boiler steel will stand this flanging in a perfectly satisfactory manner. With regard to local heating, there is probably a great difference in effect on the plate between heating along the edge and heating locally towards the middle of the plate. In any case the writer again appeals to the large experience he has now had of this method as the proof that no damage accrues to the plate. It does, however, seem to be a wise precaution to anneal the plate after the welding and flanging is completed, and before any riveting is done, and therefore these shell rings are lowered flange downwards into an annular furnace, heated to a red heat, and allowed to remain to cool down with the furnace.—*Engineer and Iron Trades' Advertiser, London.*

A GOVERNOR BOILED TO DEATH.

Electrocution is a better way to execute capital punishment than boiling, we should say. A Persian governor seems to have been legally boiled to death for embezzling.

A letter from Teheran brings a queer report to the effect that the Shah, having become much enraged against Abdullah Khauh, the governor of Mazenderan, condemned that ruler to the terrible death of being boiled alive. The charge against the unfortunate governor was that he had embezzled taxes due to the Shah's treasury.

The truth, it is alleged, is that Abdullah had not embezzled any more than he had been in the habit of doing, but that owing to poor harvests and the poverty of the peasants he did not keep the usual amount for the Shah.

This greatly enraged the monarch, who is much in need of money, and he caused Abdullah to be seized and brought to trial before the council of state, which unanimously found him guilty of embezzlement and found him worthy of death, leaving the sentence to be passed by the Shah. The latter, with a view of striking terror into other thieving governors, ordered that Abdullah should be boiled alive, but graciously decreed also that the water should be boiling hot at the time of the fatal dip, so as to finish him as quickly as possible. The sentence is said to have been carried out. The severe punishment will, it is supposed, be a lesson to other governors to be more prompt with their payments. The punishment of boiling alive has been inflicted in Persia before, and the Persians claim that under the above conditions life is destroyed immediately and there is no suffering.

QUEER ANTICS OF BOILERS.

Such is the heading of a short article in *Metall und Eisen Zeitung*, which says:—

"Boilers," said the president of a steam boiler company, "are as mysterious as human beings. A man will die suddenly of heart disease when his health seems perfect, and a boiler, like the one that exploded in Allentown, Pa., just a year ago, may be in faultless condition up to the moment of destruction. That boiler had been thoroughly cleaned and inspected a couple of hours before it burst and killed seven men. With his last breath the wounded engineer declared his ignorance of any cause. The interior of a boiler, when there is only a moderate pressure of steam, is like a small volcano, boiling and bubbling. When there is a high pressure, say 300 pounds to the square inch, everything is as still as death. The surface of the water, underneath its invisible but crushing weight of steam, is as smooth as a mirror. Increase the heat a few degrees. Nothing is changed. Throw on more coal and then go as far away as possible. For some unknown reason, at some uncertain degree of high temperature, the remaining hot water in that boiler will become instantaneously transmuted into steam, and then the crust of the earth itself could not hold that struggling demon."

CORRESPONDENCE.

Correspondents who do not want their names published are perfectly welcome to use any designation they please. But nom de plumes should always be accompanied by the proper name and address, for the editor's own information, in order that we may know that some reliable brother is responsible for what is published.

How to Organize the D. of F.

To the Editor of the American Engineer:

Sir:—In your issue of August 22nd, the question "How to organize the D. of F." was asked by one of our engineers' wives, Mrs. Frank Peerman.

In reply will say I am very happy that Mrs. Peerman has asked the question.

The object of our Order can be seen by the following

DECLARATION OF PRINCIPLES.

This organization shall be composed of the wives, widows and mothers (if widows), daughters and sisters (if unmarried and over sixteen years of age), of members of The American Order of Steam Engineers.

The objects of this organization shall be the furtherance of sociability and to aid the American Order of Steam Engineers in carrying out its great principles and objects.

The great aim of this organization shall be to give all moral and material aid in its power to its members, to educate its members socially, morally and intellectually, and to assist each other in case of sickness or distress, and render all aid possible to members of both orders.

All engineers in good standing may become honorary members, but shall hold no office, have no vote or voice, unless called upon by the Matron.

Five active members constitute a quorum.

If there is any other information or questions please do not hesitate to ask them.

I sincerely hope every engineer will give the ladies a helping hand in this work.

Do not discourage them, but help them in every way.

I remain yours in Friendship, Protection and Relief,

Miss Mary E. Deas,
8 Harrison St., Bridgeport, Conn.

Dr. Blue Blazer Criticized.

Editor, American Engineer:—

Will you kindly give me space to make a short reply to the letter of Dr. Blue Blazer in the "American Engineer" of July 25th? This would have received attention sooner, but the writer has been absent from home, and could not give it attention.

Yes, the writer was there and didn't miss the fun either. How very fortunate that I was there, the idea of any one casting reflections on Bro. Cowles, especially one who left his wife and baby at home and gave so much attention to a certain blue blazer.

I also beg to differ with Dr. B. B.'s prophesy regarding Bro. Cowles' future, as I deem it impossible for him to have other than a calm and peaceful life, and believe him to be the right man in the right place as manager of the organ of the A. O. of S. E.

The writer was very much impressed with the convention, and trusts that before the Chicago meeting, in '93, Dr. B. B. will have his "ruffled feathers smoothed," and think more favorably of the A. O. of S. E. from the Supreme Chief to the delegates, etc., and be ready to admit that the Order is level headed in the selection of delegates, etc.

I wonder, if Dr. B. B. was a delegate, in what mental condition could the council have been that sent *him*? However, seriously, we had lots of fun at Bro. B. B.'s expense, financially and otherwise, and we appreciate his desire to make it pleasant for all. So, with pleasant memories of the convention, and the hope to attend the Chicago meeting in '93, and with thanks to the editor for the space used.

Very truly,
That "Elegant Lady from Rochester."

Old Slide Valve and Corliss Engines.

To the Editor of the American Engineer:

Sir:—This Old Slide Valve vs. Corliss question is getting exciting; although engineers don't often get excited as a rule.

Now, Old Slide Valve says he can prove that 60 m. e. p. is economical. If he can, why don't he?

Old Reliable's argument is good enough; but he doesn't say what kind of engineers were in the confectionery and coffee plants. Perhaps the coffee firm had an engineer that didn't attend to business; and, on the other hand, the confectionery engineer may have been A 1. And again, ten days for repairs is a long time in a city like St. Louis; why, they could have built a new engine in that time.

I have run all kinds of engines, and I find that the Corliss is most powerful, the easiest to handle, and in every respect the best engine of the two. I think if O. S. V. would use a little more emery cloth and tripoli, and not so much paint, he can make a "dude" of his engine. Now let some of the boys talk. If they were all like the Recording Engineer of Kensington Council (No. 3) they would get there. Anyway for a steady running, hard pulling engine give me the

Old Corliss.

The Ball Game.

To the Editor of the American Engineer:

Sir:—You have had reports of that great ball game between Kensington No. 3 and Southwark No. 4, Pa., at Brandywine Springs. But you don't seem to have heard anything of the horse race between Bros. Dawson and Williams of Delaware County Council No. 6. Well, I will tell you; but don't give me away.

The two brothers mentioned visited Speak Easy pretty often. Dawson commenced to blow about a horse he has that can trot inside of 2½; and Williams said he could procure one to beat that. Finally they agreed to run a race on hobby horses. Dawson was defeated. Then both had some ginger ale to drown their sorrow, when Bro. Dawson's watch jumped out of his pocket; but it was caught, right on the wing, by Bro. Williams, who returned it to the owner. Then all the brethren from Philadelphia pulled out their watches to see if each was all right. All was serene. Then there was great rejoicing followed by more ginger ale.

All's well that ends well.

Blow Off.

Kalamazoo Council, No. 7, Mich.

To the Editor of the American Engineer:

Sir:—Fred F. Unckrich has been elected chief engineer of Kalamazoo Council, No. 7, Mich. And we are progressing swimmingly.

J. E. McEntee, Cor. Engr.

Jas. Bingham Expelled.

To the Ed. American Engineer:

Sir:—Please announce that Bro. Jas. Bingham has been expelled from the Maple City Council, No. 5, Pa., for non-payment of dues.

W. E. Cook, Cor. Engr.

Resolutions of Sympathy.

To the Ed. American Engineer:

We, the members of Maple City Council, No. 5, of Adrian, Michigan, are called upon to perform the painful duty of recording the death of the son of Brother S. S. Garns, aged 5½ years, which occurred at Toledo, Aug. 7th, by being run over by an ice wagon, whereby the Council, at its regular meeting, adopted these resolutions:

Whereas, It has pleased the Supreme Ruler of the Universe to remove from our midst the son of Brother Garns; therefore be it thus

Resolved, That the American Order of Steam Engineers, of Adrian, extend our sympathy to the bereaved father and mother, during this their hour of sorrow; and be it also

Resolved, That a copy of this be sent to the American Engineer, for publication, and a copy spread on our minutes, and also sent to the bereaved family.

M. G. Gippert,
W. E. Cook,
T. C. Roberts,
Committee.

THE STEAM JACKET.

An exchange pertinently states that one of the vexed questions in steam engineering to-day is of how much use is the steam jacket. Some authorities say it is a valuable addition to a steam engine, others that it makes no appreciable difference in economy, and others still that it is a source of positive loss. To the best of our knowledge the balance of opinion is now in favor of doing without a jacket, yet, in large slow running engines there can be no doubt about the gain in using jacketing, it provides a very useful means of warming up the engines, but to heat jackets with fresh steam and taking into account the complications in connection therewith, the balance in economy will be found on the side of the unjacketed engine and in confirmation of this view we may say that more than half of the ocean engines are unjacketed.—*Marine Engineer.*

Lieutenant Hunt's article on "The Steamship Lines of the World," in *Scribner's Magazine*, for September, is a very compact account of the great ocean routes of travel which connect the principal ports of the world, with a description of the varying comforts and luxuries of the steamers, and life on board and the striking features of strange ports. This article combines the interest of a narrative of travel with an immense amount of condensed information in regard to time, distances and cost, which everyone who travels, or hopes to travel, will be glad to find available in so small a compass as a single magazine article. There are a number of attractive illustrations, a chart of the world showing the principal steamship routes, and several statistical tables. The author has traveled over most of the great routes described, and has the further advantage of being connected with the naval intelligence office in Washington, where all the facts in regard to maritime affairs are collected.

MODEL OF AN IMPROVED MARINE ENGINE.

The following description of the model is from the *Locomotive*:

It is only a few years since the compound condensing engine was considered the best possible engine for marine use; but already the triple expansion engine has replaced it in the better class of sea-going vessels, and many comparatively new and costly compound engines are being taken out and replaced by the more economical triple expansion ones. It seems, furthermore, to be only a question of time when these in turn will give way to the quadruple expansion engine, in which steam is expanded in four cylinders and then passed into the condenser.

Mr. Frank Chaese, in the employment of the Hartford Steam Boiler Inspection and Insurance Company, has just completed a working model of an engine of this kind, which weighs about thirty pounds and contains upwards of three thousand six hundred parts. The high-pressure cylinder is $\frac{7}{8}$ inch in diameter, the first intermediate cylinder is $1\frac{3}{8}$ inches in diameter, the second intermediate 2 inches, and the low-pressure cylinder 2 13-16 inches. The stroke is $1\frac{3}{4}$ inches, and the engine is designed to make 130 revolutions a minute and run under a boiler pressure of 200 pounds to the square inch. All the cylinders are provided, top and bottom, with relief valves of ample area, with pipes for attaching indicators, and with cylinder drain cocks.

The engine has two cranks set at right angles, the forward one connecting with the piston rod from the high-pressure and first intermediate cylinders, while the aft crank connects with the piston rod of the second intermediate and low-pressure cylinders. All of these cylinders are jacketed with live steam, which enters the jacket at boiler pressure and is dipped into the condenser. In starting up the engine the jacket valve is first opened and steam blown through into the condenser. This heats the cylinders up to the working temperature, and facilitates getting the condenser into operation. Outside of the steam jackets there is an air space, and then comes a non-conducting jacket of asbestos, while outside of all there is a neat wooden lagging composed of alternate strips of mahogany and white maple. The cylinders being arranged in pairs, tandemwise, and the engine being vertical, tail rods were not considered essential, especially as the stuffing boxes have very long sleeves, as will appear later on. The piston fits the cylinder nearly steam tight, but two grooves are cut in each and packing rings with a diagonal slit are sprung into them.

The usual way to secure the pistons of marine engines to the rods is to make the rods slightly conical where the pistons come, and fasten the pistons securely down on the tapering part by means of jam nuts. The objections to this model are that the piston cannot be adjusted after setting up the engine, and in case of accident or other emergency, they cannot readily be removed. In Mr. Chaese's engine an attempt has been made to overcome these objections by fitting the piston to a collar, which is adjustable to some extent on the rod, and from which the piston may be readily removed.

The stuffing boxes on the crank ends of the lower cylinders do not differ materially from those now in use; but a special arrangement, having distinct advantages over the ordinary stuffing boxes, has been provided between the upper and lower cylinders. A long sleeve that fits over the piston rod is bolted to the lower head of the upper cylinder. On the upper head of the lower cylinder a split stuffing box is bolted, which may be entirely removed from the rod if desired. The bottom of this stuffing box consists of a split collar, which fits around the piston rod, and may also be readily removed. The long sleeve that projects downward from the upper cylinder passes through the gland of the lower stuffing box, and packing is inserted in the box in such a manner that it presses downward against the split collar referred to above, inward against the piston rod and the long sleeve, upward against the gland and the lower end of the sleeve, and outward against the split stuffing box. All the cylinders and valve chambers are fitted up in this way, and the arrangement is effective and simple, since it dispenses with one entire set of stuffing boxes. By removing the split stuffing box and the split collar about the rod, the upper head of the lower cylinder, for instance, may be raised until it rests against the lower head of the upper cylinder; and the pistons and valves may be readily reached for examination, adjustment or repairs.

The upper cylinders and valves are kept at the proper distance from the lower ones by six columns, which are secured by means of set screws let into their ends. By removing the two screws, any one of these columns may be taken out to allow of the removal of pistons, or for giving greater facility of access when packing.

The engine has no receivers, the valves and nozzle being of sufficient size to serve this purpose. The valves are of the piston form, the upper piston being slightly larger than the lower one, so that when the engine is in operation the pressure of steam on this excess of area balances the weight of the valve, spindle, and rods attached. The cranks are set at 90°, and the eccentrics (of which there are four) are at 120° with the cranks. Three of the eccentrics are keyed on, as usual; but the fourth eccentric, which is used on the forward or high-pressure engine in going ahead, is attached to a projection from the shaft by means of a long screw with two nuts, and the lead of this eccentric may be changed by varying the position of these nuts on the thread.

The reversing gear of the engine is operated by steam. It consists of a pair cylinders arranged as in a pump, the upper one of which is supplied with steam by means of a two-way valve, so that live steam can be admitted to either side of the piston. The lower cylinder is filled with oil, and a passage runs from the upper side of its piston to the under side of it. In this side passage is a valve which locks the reversing gear when it is closed. The piston rod of this oil pump is attached to the lever that controls the links, and the mode of operating the gear is as follows: The valve in the oil passage is closed and steam is turned on in the upper cylinder. The oil valve is now opened quickly or slowly according as it is desired to reverse the engine quickly or slowly. In event of accident to the steam reversing gear, a small force-pump, to be worked by hand, is provided, which draws oil from one end of the oil cylinder and forces it into the other end, thus shifting the link lowly in the same manner that the steam mechanism does. The passages for oil and steam are cast in the body of the reversing gear, so as to do away with piping. By the method of suspension of the link and block a sort of parallel motion is attained, which greatly lessens the slipping of the block, and gives a quicker admission and cut-off.

The piston rods are screwed into the cross heads, and are provided with jam nuts, so that they can be removed if necessary. The shoes are broad and long, and are provided at their lower ends with brushes that drip into oil boxes and keep the slides oiled. Ample means of lubrication are provided at all points. The bearing against which the wear comes in going ahead, has a detachable plate, so that it can be removed in case of wear. One leg of the frame supporting the engine is utilized as an oil reservoir, and to the front of this leg a revolution-counter is secured.

The condenser has 260 square inches of surface, and is very efficient. Water circulates through the tubes and all around the condensing space. Feed water is taken from the hot well by two pumps operated by side levers from the engine, either one of which has sufficient capacity to supply the boilers. Each pump has an air chamber and a relief valve, so that if the boiler valves are closed the feed pipes will not be ruptured. The pump cylinders are considerably below the level of the water in the hot well, so that they will take boiling water if necessary. To provide for the loss of water that unavoidably occurs, there is a passage between the steam and water spaces of the condenser, in which a valve is placed. All the pumps have pet cocks, so that the engineer may assure himself that they are working properly. The circulating pump is double-acting, and is made larger than usual in order that an ample supply of condensing water may be had, even when the ship is in tropical latitudes. Pipes are dispensed with about the engine wherever this is possible. The bilge pumps are by the side of the circulating pumps, and are operated by the same side levers. The hot well is provided with an escape pipe for vapor, a manhole for cleaning, and a glass gauge for showing the height of water. On the bottom of the condenser is a shifting valve, which prevents the water from backing up in the condenser and choking the engine. The condenser is made in a single casting, as the bed of the engine itself, and it is provided with mudholes and large, easily accessible end doors for getting at the water side, and with a manhole for getting at the steam side.

The crank shaft is in two sections, exactly alike. Where these sections come together they are flanged, and are secured together by a dowel, which can be removed readily in case it is desired to separate the forward and aft engines. The bearings have brass bushings and oil boxes and a water service leads from the circulating side of the condenser, for use in cooling the bearings should they become heated in spite of the abundant provisions for lubrication. All bearing surfaces are made unusually large.

Just back of the aft main bearing a large gear wheel is secured to the shaft, which engages with a worm driven by an auxiliary engine, entirely distinct from the main engine, which can be readily thrown in and out of gear. This device is very serviceable when it is desired to turn the main shaft slightly, so as to gain access more freely to the parts in cleaning up and repairing. This auxiliary engine is double-acting and has two steam cylinders working on cranks set at right angles. It has no eccentrics, links, or connecting rods, and its valves are operated in a very simple manner by cams on the shaft. It is reversed by reversing the steam by means of a two-way valve. In addition to the two steam cylinders, it has a pair of water cylinders, so that by throwing the worm out of gear it may be used as a powerful feed pump, bilge pump, circulating pump, donkey pump, etc., as necessity may require.

We have now to consider its disconnective features. In case the forward engine breaks down from any cause, steam is first shut off entirely. The forward and aft engines are then separated by removing the dowel that unites the two lengths of shaft on which they operate. The valve between the two intermediate cylinders and the throttle valve into the high pressure cylinder are next closed, and the auxiliary engine for turning the shaft in dock is pressed into service as a circulating pump.

Steam is then turned on to the second intermediate and low-pressure cylinders through a reducing valve and the aft engine is run as a compound condensing engine. It should be said that this reducing valve is serviceable in starting up the large engine at all times, until a proper flow of steam is established through the cylinders. A blow-through pipe to the low-pressure cylinder is also provided, so that the engineer can admit a little live steam into this cylinder if he considers it desirable to do so, at any time.

In case it is the aft engine that breaks down, steam is first shut off as before, and the connecting rod from the low-pressure cylinder is removed from the crank-pin and secured in an out-of-the-way position. The valve between the two intermediate cylinders is closed, and connection is made between the first intermediate steam chest and the condenser. The auxiliary engine is then used as an air pump. Upon opening the throttle valve once more the forward engine runs as a compound condensing engine.

The thrust-block, instead of being made in the usual form, with collars running in grooves, is provided with conical rollers which run in oil, and have very little friction.

The engine we have described is made to represent an ideal engine of the following dimensions, on a scale of ¾ inch to the foot: Diameter of cylinders, high-pressure, 14″; first intermediate, 22″; second intermediate, 32″; low-pressure, 45″; stroke, 28″. Boiler pressure, 200 pounds; speed, 130 revolutions a minute; condenser surface, 700 square feet. When the engine is in full gear, steam is cut off at half stroke in the forward engine, and at five-eighths in the aft engine.

The engine takes up very little room fore and aft. All parts—connecting rods, valve stems, eccentrics, etc.,—are in duplicate, and are all readily accessible for repairs.

Mr. Chaese's engine is on exhibition at the home office of this company, and any of our friends who would like to see it are invited to come and do so.

WORLD'S FAIR NOTES.

It is reported that the Prince of Wales, Emperor William of Germany, and the Shah of Persia all seriously contemplate visiting the World's Fair in 1893.

The managers of the great naval exhibition at Chelsea, England, have consented to allow the model of Nelson's ship, the *Victory*, to be transferred to the Columbian Exposition.

More than $5,000,000 of Exposition work is now contracted for and is in progress.

A movement has been inaugurated by the Sons of the Revolution in New York to have October 12th celebrated throughout the world each year as "Discovery Day."

The $10,000 painting of Christopher Columbus, executed by the famous Moro in 1540, and purchased in London by Charles F. Gunther, has arrived at the custom house, Chicago, and will be displayed at the Fair.

The Sultan of Zanzibar has decided to make an extensive exhibit, and a request for space has been cabled.

Massachusetts will devote $10,000 to its educational exhibit. The State's entire appropriation is $75,000.

An interesting collection from Asiatic-Russian provinces is being exhibited on the Champs Elysee in Paris, and it is said will be taken to Chicago in 1893. The exhibition is in charge of Gen. Annenkoff, son of the Princess Dolgorouki (morganatic wife of Alexander II), who is the head of the great trans-Caucasus railway into Turkestan and Afghanistan. The collection comprises natural products of Central Asia, and arms, clothing, jewels, and household articles of the various provinces, as well as a panorama of a battle in Turkestan, with scenic illustrations of the snow-capped mountains.

At Virginia's World's Fair convention, held at Pulaski, it was shown that the people of the "Old Dominion" are not lacking in interest in the Columbian Exposition, but, on the contrary, are determined to be worthily represented. The feeling was nearly unanimous in favor of asking the Legislature to make an appropriation of not less than $100,000.

The Exposition European Commission, embracing Messrs. Butterworth, Handy, Bullock, Lindsay, and Peck, is receiving very marked attention in European capitals and other cities, and everywhere exceptional courtesies have been extended. The Commission is doing a wonderful amount of good to the Exposition in arousing interest abroad and insuring extensive participation by foreign nations.

Lieut. Frederick A. Ober, one of the Special Commissioners to South America, has written that he has secured in San Domingo photographs of the bones alleged to be those of Christopher Columbus. He is inclined to question that the remains are genuine. He has also made a facsimile of the historic cross of one of the cathedrals in that city from material that was put in the building in 1514. These and many other relics he will bring to the Exposition.

Guatemala has appropriated $100,000 in gold for its exhibit at the Exposition, and $20,000 additional for its building.

Col. Fred. Brackett, chief clerk of the Treasury Department, has been appointed special agent of the department, under Section 12 of the World's Fair Act, relating to the admission of foreign goods intended for exhibition at the Fair. He will establish in London a bureau of information for the benefit of intending exhibitors, where he will supply to all applicants information relative to the methods of shipment and entry of goods intended for exhibition at Chicago, routes and cost of transportation, methods of caring for goods unaccompanied by agents, regulations for returning the same to exhibitors, etc.

Of the 106 counties in Kansas eighty-five have organized World's Fair associations for the purpose of raising their apportionment of the $100,000 which Kansas started out to provide for its representation at the Exposition. Twenty-two counties have already raised their full share.

Lieut. H. R. Lemly, the Special Commissioner of the Exposition at Colombia, writes that a typical orchestra from that country, consisting of ten musicians, playing their native instruments, which are unlike those of any other people, has been organized. It will appear in Chicago during the Exposition, in connection with the exhibit from the Republic of Colombia.

Chief Fearn has received a letter from Consul-General Frank Mason, at Frankfort-on-Main. He says he has recently visited the old town St. Die, in France, where was published the "Cosmographia Introductio," the book which gave America its name. He says he is collecting rare manuscripts in relation to the discovery of America, and other valuable relics and will show them at the Exposition.

The Territorial convention of the Liberal party in Utah has voted to request the Legislature to appropriate not less than $100,000 for the Territory's representation at the Exposition. It is reported that the Democratic and Republican conventions are certain to take similar action.

The Art Department has issued a strong circular urging every architect in the United States to personally assist in an exhibit of American architecture. The manifesto says: "The membership of the American Institute of Architects includes all the well-known names, in different parts of the country, of men to whom the growth of American architecture, as distinguished from mere building and construction, is due, and of which they are to-day the honorered presentatives. It is through these men that the growth of fine architecture and of the professional and social status of its practitioners in this country during the last thirty years has been developed; and the influence of the work of the Institute on public-spirited laymen of artistic cultivation has been marked."

Lieut. W. E. Safford, U. S. N., Special Commissioner of the World's Fair to Peru and Bolivia, has secured for the Latin-American department of the Exposition five samples of the ceremonial dresses of the Jiberos and Zaparros Indians. One of the Jiberos costumes is reported to surpass any of the dresses of savage tribes yet discovered, in gorgeous beauty and lovely contrast of colors. The two Zaparros costumes are woven of human hair, and are ornamented with geometrical designs.

Letters received by the Latin-American Department of the Exposition indicate that Mexican women will take a prominent place at the World's Fair. The country has long been celebrated for the variety of needle-work made by drawing threads from linen, which is known as Mexican work. Although now so fashionable in newer portions of the world, the making of it is an ancient art in Old Mexico, and exquisite specimens of the lace like work are to be found in the antique altar-cloths of the ruined missions. The women also do curious and beautiful embroidery in silver and gold, for the gorgeous sombrero, without which no Mexican horseman is perfectly equipped. Toluca women make by hand a peculiar kind of durable and pretty lace.

The effort to have a tribe of African pigmies exhibited at the Exposition is pretty certain to succeed. Tippoo Tib has given his consent and the consent of the King of Belgium, which also is necessary, can be easily obtained, it is believed, through the State Department.

The Very Reverend Doctor Peralta, Bishop of Panama, has tendered for exhibition at the World's Fair his very remarkable historical and ethnological collection which has been for some years in a museum connected with the bishop's palace. It is one of the most supurb private collections of antiquities in the world, including ancient gold and silver ornaments, vessels and objects of worship exhumed from the tombs of the extinct race that once inhabited Colombia, rare vases, pottery and earthenware, rare ornaments, vessels and missals that date back to the time of the conquest, papers and manuscripts, and various other articles of historical interest. The offer has been accepted and the collection will be shown at Chicago.

The photographers of the country want a separate building at the Exposition, adapted to a magnificent photograph exhibit collected from the whole world. A committee has been appointed to confer with the Exposition officials upon the subject.

Arkansas, at its recent World's Fair convention, which was a very enthusiastic one, adopted a plan of the stock company order whereby it expects to raise $100,000 for its representation at the Fair.

Eugene and Paul Champion, of Neuilly-sur-Seine, France, have proposed a series of electrical fireworks for the Exposition. Neither gunpowder, dynamite, nor other explosive material is used in producing the dazzling effects. An operator sits at an instrument something like a piano and by manipulation of the keys produces designs of the most gorgeous fashion. The whole machine is run by electricity. One of the pieces suggested is a representation of Chicago as a statue of fire. This is to be surrounded by other figures of flame, each representing a State of the Union. Chicago will be represented as receiving the homage of all the great powers of the world, each filing past the statue and assembled states. As the figures pass before Chicago each will halt, bow, and then lay down a flag or shield of fire at Chicago's feet, receiving in return the palm branch of peace. The display would last forty minutes, and during that time no less than 40,000 distinct effects could be produced.

The Expostion Directory has taken action under which adequate insurance will be placed upon all

persons and property for which it can be held liable during the Fair. It is the intention to place an insurance of something like $300,000,000 on the exhibits.

Gen. L. A. Grant, Acting Secretary of War, has notified Director-General Davis that he approved of Maj.-Gen. Schofield's recommendation that Gen. Nelson A. Miles should command the troops, whether regulars or National Guard, at the dedicatory ceremonies in October, 1892. This practically settles the question. The military feature of these ceremonies is to be an important one. Probably 10,000 soldiers will participate, and those of the National Guard who will have the honor to take part will be crack companies from the different States—those that have shown that they excel in discipline, marching, and drill. Competitive drills to determine which companies shall take part in the great event will probably be instituted in every State having a National Guard.

No side shows are to be permitted within the Exposition grounds. The Directory has decided that the entrance fee shall entitle the visitor to see everything within the inclosure. There will be, however, several theatres built and kept running, at which the finest talent in the world, it is expected, will appear, and visitors who choose to attend the performances will have to pay an admission fee. Such sights as "A Street in Cairo" will be free, but natives of oriental countries in a few cases will be allowed to charge a small fee to special performances of a theatrical nature.

Many interesting relics from San Domingo where Columbus landed, have been received by the Washington office of the foreign affairs department of the Exposition. The most valuable of these relics and the most interesting, perhaps, is the first church-bell that ever rang out in the New World. It was presented to the colonists of the first settlement of San Domingo by Queen Isabella in appreciation of the fact that the first settlemet bore her name. There is also an exact reproducti n of the cross which Columbus raised immediately upon landing. The material of the cross is the same exactly as that which Columbus nailed up, having been taken from the wood of a building erected in 1509. There are also in this collection fac-similes of the doors which close the cells in which the bones of Columbus repose. The carving on these doors is exquisite and they themselves are beautiful as a whole. There is also an anchor, supposed to have been lost by Columbus when his ship went to pieces at San Domingo on a subsequent voyage.

Capt. D. P. Dobbins, Superintendent of the Life-Saving Service of Lakes Erie and Ontario and the Ohio River, is trying to complete arrangements for the exhibition, at the World's Fair in Chicago, of the gunboat *Niagara*, which is sunk in a good state of preservation in Massasauga Bay, Erie Harbor. Captain Dobbin's father was the builder of the American fleet of 1812-15, and the Captain has in his possession Commodore Perry's personal records and memoranda. The *Niagara* and *Lawrence* were sunk soon after the engagement on Lake Erie eighty years ago; the *Lawrence* was raised and taken to Philadelphia in 1876, but was burned there. The The *Niagara* was purchased by Capt. Dobbins and taken to Erie where she still lies under water. The guns with which the *Niagara* was originally manned have been secured, and will be upon the decks at the Fair. Captain Dobbins planned and helped put into operation the first life-saving station on the great lakes.

The Human Body.

God made the human body, and it is by far the most exquisite and wonderful organization which has come to us from the Divine hand. It is a study for one's whole life. If an undevout astronomer is mad, an undevout physiologist is madder. The stomach that prepares the body's support; the vesse's that distribute the supply, and send it round; the lungs that aerate the all-nourishing blood; the muscle-engine which, without fireman or engineer, stands night and day pumping and driving a wholesome stream with vital irrigation through all the system, that unites and harmonizes the whole band of organs; the brain, that dwells in the dome high above, like a true royalty; these, with their various and wonderful functions, are not to be lightly spoken of, or irreverently held.—H. W. Beecher.

LITERARY.

The American Society of Civil Engineers have issued Vol. 24 of their transactions.

The Institution of Civil Engineers, London, have issued a series of valuable pamphlets, comprising papers read before them during their past session (1890-91).

The Engineers' Club of Philadelphia have published their volume of proceedings for April, containing the annual address of the retiring president, H. W. Spangler, together with his portrait as frontispicce. Mr. Spangler's numerous friends will regard this as a valuable memento.

House Heating.

The *Metal Worker* essays on house heating, by steam, hot water, and hot air, have been issued in book form; copyrighted and published by David Williams, New York. Some time ago the *Metal Worker* opened prize competitions in essays on house heating. As these were published, one after another, they attracted unusual attention. These, with plans, specifications and comparisons of the various heating systems in vogue,are comprised in the book which Mr. Williams has just issued. It is a most valuable book to all interested in house heating.

BUSINESS TRANSACTIONS.

The Phoenix Hand and Power Crane Co., Cleveland, O., report business, in their line, better than ever. Their list of orders on hand is longer than usual. Bro. Wm. H. Thompson is general manager.

The Ball Engine Co., Erie, Pa., have opened a branch office in Chicago in the Rookery Building, room 506. Mr. Albert Fisher, widely known as a successful salesman and an agreeable gentleman, has been appointed manager, and will be glad to see his friends in his new quarters. Mr. Fisher has had a large experience in engines, and we predict for him success in his new connection.

The Machinists' Supply Co., of 167 Lake St., Chicago, have issued a catalogue which is useful to tool users and other machinists, even as a book of reference. Their 1891 edition (catalogue No. 3) contains many additional illustrations over previous issues. And, of course, where prices differ, those in the later catalogue prevail.

One of the largest of the recent electric railway contracts has just been closed by the Short Electric Railway Company, covering the equipment of four or five street railways in and around Wilkesbarre, Pa. The Wilkesbarre & Wyoming Valley Traction Co., (of which Mr. B.F. Meyer, of Harrisburg, is president,) has been formed to consolidate the railways in Wilkesbarre and the long, narrow valley containing a number of prosperous townships. Senator Jno. J. Patterson is one of the interested parties. The roads are to be equipped electrically at a cost of over $200,000.00, and the Short Company has secured the contract for dynamos, motors, "Gearless" type and about 40 will be required for present necessities. It is intended to make this one of the most perfectly equipped roads in the country.

CHICAGO, MILWAUKEE & ST. PAUL RAILWAY.

Electric Lighted and Steam Heated Vestibuled Trains, with Westinghouse Air Signals, between Chicago, St. Paul and Minneapolis, daily.

Electric Lighted and Steam Heated Vestibuled Trains between Chicago, Council Bluffs and Omaha, daily.

Through Vestibuled Sleeping Cars, daily, between Chicago, Butte, Tacoma, Seattle, and Portland, Ore.

Solid Trains between Chicago and principal points in Northern Wisconsin and the Peninsula of Michigan.

Daily Trains between St. Paul, Minneapolis and Kansas City via the Hedrick Route.

Through Sleeping Cars, daily, between St. Louis, St. Paul and Minneapolis.

The finest Dining Cars in the World.

The best Sleeping Cars. Electric Reading Lamps in Berths.

6,100 miles of road in Illinois, Wisconsin, Northern Michigan, Iowa, Minnesota, Missouri, South Dakota and North Dakota.

Everything First-Class.

First-Class People patronize First-Class Lines.

Ticket Agents everywhere sell Tickets over the Chicago, Milwaukee and St. Paul Railway.

American Agricultural Machines Wanted.

A German wholesale firm, with English and German references, dealing in agricultural machines, wishes to buy for cash American agricultural machines of latest and approved construction and invites cheapest offers to be forwarded to F. A. 7071, care of Rudolf Mosse, Berlin, S. W. (Germany).

A Mechanical Engineer having had a large experience in a wide variety of engineering work, and possessing a high degree of ability in designing, estimating, supervision and economical management, desires engagement. Address "A E," Box 589, Ravenswood, Ill.

Map of the United States.

A large, handsome map of the United States, mounted and suitable for office or home use, is issued by the Burlington route. Copies will be mailed to any address on receipt of 12 cents in postage by P. S. Eustis, Gen'l Pass. Agent, C., B. & Q. R. R., Chicago, Ill.

An Opening.—A chief engineer of three years' experience in southwest Virginia, east Tennessee and North Carolina would like to meet one or two bright men with $100.000 each who could complete 15 miles of railroad on which $60,000 cash has been expended for grading this season. The present company are local men who have run out of cash, but the project is as good as ever, and the opportunity now occurs to take advantage of their misfortune. No debts are owing, no bonds have been issued, and about $150,000 of local bonuses are promised. The inducements to take hold are: when built this railroad will inevitably be required by the projected extension of a present large system; it will pay handsomely from the start; and, best of all, large mineral and timber properties can now be secured cheaply, whose value would be greatly increased by the completion of this railroad.

I have no money and no financial connections, but have this opportunity and can give the highest professional references. Address Chief Engineer, P. O. Box 360, Bristol, Tenn.

CONTRACTS OPEN.

Iron Bridge.—Proposals for an iron bridge between the counties of Bergen and Passaic, New Jersey, will be received at the conrt-house, Hacken-ack, the 8th day of September, at 3 o'clock p. m.. Plans and specifications may be seen at the residence of Albert Bogert, Fairlawn, Bergen Co., N. J., and at the office of James Carroll, No. 10 Ramapo avenue, Patterson N. J. Albert Bogert, chairman of Joint Committee.

Water Works and Electric Lights. — Sealed proposals for the construction of a system of Water-Works and Electric Lights for the City of Metropolis, Illinois, are hereby solicited. The said Water and Light plants to be constructed in accordance with plans and specifications now on file with the City Clerk of said City of Metropolis, Illinois, and to be seen there only. Bidders must deposit with the Clerk a certified check for $500 as an evidence of good faith.

Notice is further hereby given that the contractor must furnish the money to put in said works, and that he will be repaid in a fixed annual rental, to be agreed upon between the parties, after a sum of not less than $5,000 has been paid down in cash by said city, together with interest on the deferred payments.

Bids will be received separately or jointly for the construction of either plant. The said City of Metropolis also reserves the right to reject any and all bids.

Bids to be opened Thursday, September 10, 1891.

A. Quantee, Mayor.

Bart. Kerr, City Clerk.

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Bids to be opened Thursday, September 10, 1891. A. Quante, Mayor, Bart Kerr, City Clerk.

U. S. Court House, Etc., at Denver.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock p. m., on the 8th day of September, 1891, for all the labor and materials required for the joinery work, wood flooring, marble work, vault doors, cement floors, etc., for the U. S. Court House and Post Office, etc., building at Denver, Col., in accordance with the drawings and specifications, copies of which may be had on application at this office or the office of the Superintendent at Denver, Col. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Each proposal must be inclosed in an envelope, sealed and marked, "Proposals for the Joinery Work, Marble Work, etc., for the U. S. Court House and Post Office, etc , building at Denver, Col.," and addressed to W. J. Edbrooke, Supervising Architect.

Iron Work, Etc. — Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock p. m., on the 28th day of September, 1891, for all the labor and materials required for the iron stairs, iron work, etc., of elevator shaft, for the U. S. Court House, Post Office, etc., building at Denver, Col., in accordance with drawings and specifications, copies of which may be had on application at this office, or the office of the Superintendent at Denver, Col. Each bid must be accompanied by a certified cheek for a sum not less than 2 per cent. of the amount of the proposals. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in envelopes, sealed and marked. "Proposals for Iron Stairs, Iron Work, etc., for the U. S. Court House, Post Office, etc., building at Denver, Col.," and addressed to W. J. Edbrooke, Supervising Architect.

THE WOODCOCK PULLEY CLUTCH AND CUT-OFF COUPLING.

The illustrations on this page show the features of the new pulley clutch and cut-off coupling manufactured by the Allentown Foundry and Machine Co.. of Allentown, Pa., nnder the patent of W. J. Woodcock, of Auburn, N. Y.

The device is shown as a whole and in detail. It is needless to say that the middle cut shows the pnlley clutch and cut-off coupling in working order. It consists of few parts, is simple in construction and compact in arrangement. An end view is shown in Fig. 1, while Fig. 2 is a longitudinal section of the clutch. The long hub *I* cast to the pulley is bored out and lined with a brass bushing *J*. This pulley runs loosely on the shaft, and the long hub of the flanged coupling *H* is keyed on the shaft. The hub of this coupling is turned off to allow the sleeve *G* to move longitudinally on it.

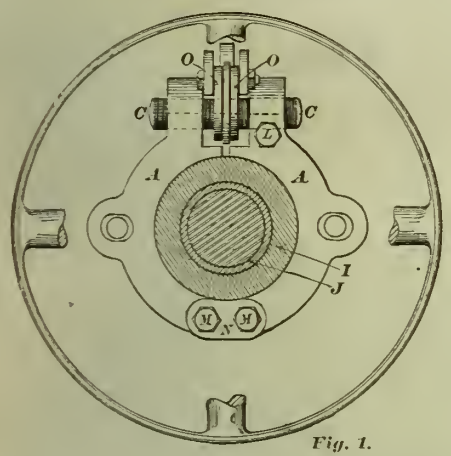


Fig. 1.

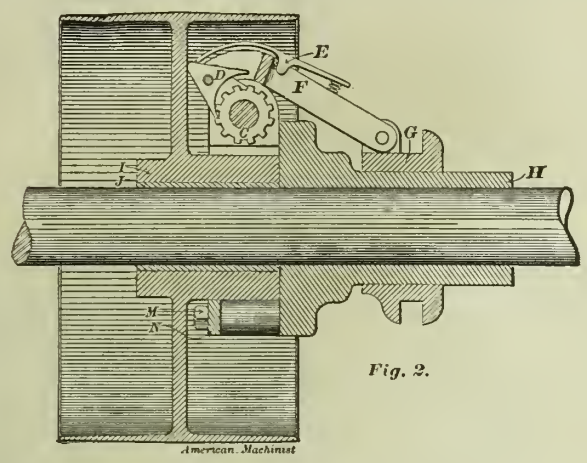


Fig. 2.

NEW PULLEY CLUTCH AND CUT-OFF COUPLING

Fig. 3 shows a separate view of one of the clamps *A A*, shown in Fig. 2; each clamp is pivoted on a bolt *M*; these bolts are fitted into the flange of the coupling *H*, so as to cause the clamps to revolve with the conpling. For further secnrity a plate *N* is placed under the heads of the bolts *M M* to tie the two together. The right and left-handed screw *C C* works in brass nuts, which are fitted in the clamps *A A*, and by turning this screw in one or the other direction the clamps *A A* are either tightened or loosened on the hub *I* of the pulley.

For the purpose of turning the screw *C C* in either direction, a ratchet wheel is fastened to the center, which engages with the pawl *D*; the pin, on which this pawl works, passes through two links *O O*, which are free to rotate on the screw *C C*; this pin also passes through the forked end of the lever *F*, which is shown separately in Fig. 4. The other end of this lever is attached to the sleeve *G*, as shown.

From the foregoing it will be seen that the links *O O* form a connection between the screw *C C*, the ratchet wheel, pawl, and the lever *F*. A finger *E* is fulcrumed on the back of the lever *F*, and the spring 1, acting at one end, causes the other end of the finger to press on the pawl *D*, keeping the latter engaged with the wheel. Now, by means of a snitable fork the collar in the groove of the sleeve *G*, a longitudinal movement can be given to the sleeve while the shaft is in motion. When the movement of *G* is towards the pulley, the lever *F* is carried forward, and the pawl and ratchet act to tighten the clamps *A A*, thereby transmitting motion to the pulley; when a loosening of the clamps is required the sleeve *G* is moved back sufficiently to reverse the pawl *D*; the finger *E* in this case will bear on the other side of the pawl, causing the ratchet wheel to loosen the screws. This at first sight may seem to be improbable, but it will be found on investigation that, as the lever *F* recedes the position of the pawl *D* relatively to the lever *F* changes, and when a certain distance has been passed over, the finger *E* has ridden over the outer edge of the pawl *D*, and the pressure is applied to the side of the pawl opposite to that shown in the illustration. By this simple means the position of the pawl is quickly changed, thereby producing an action either for tightening or loosening the screw *C C*, according to which side the pawl is engaged with the ratchet wheel, the whole arrangement requiring but a small space on the shaft. A marked advantage is claimed for this clutch, namely, the tightening may be gradual, thereby starting the machinery slowly, and by further tightening, all slipping on the pulley is prevented. For dynamos, and other machinery requiring caution in starting, this clutch is said to be well adapted.

For cut-off couplings the pulley part is not required; one section of the shaft extends into the hub *I* sufficiently far to support it while running loose, and the hub *I* is keyed or the other section of the shaft.

At *L* a screw is provided when soft metal or a wooden plug is to be brought into contact with screw *C*. By tightening the screw *L* the plug is brought into contact with *C*, and makes it tighter in the thread, so as to stand without loosening when in use.

Further information may be obtained by addressing the Allentown Foundry and Machine Co., as above.

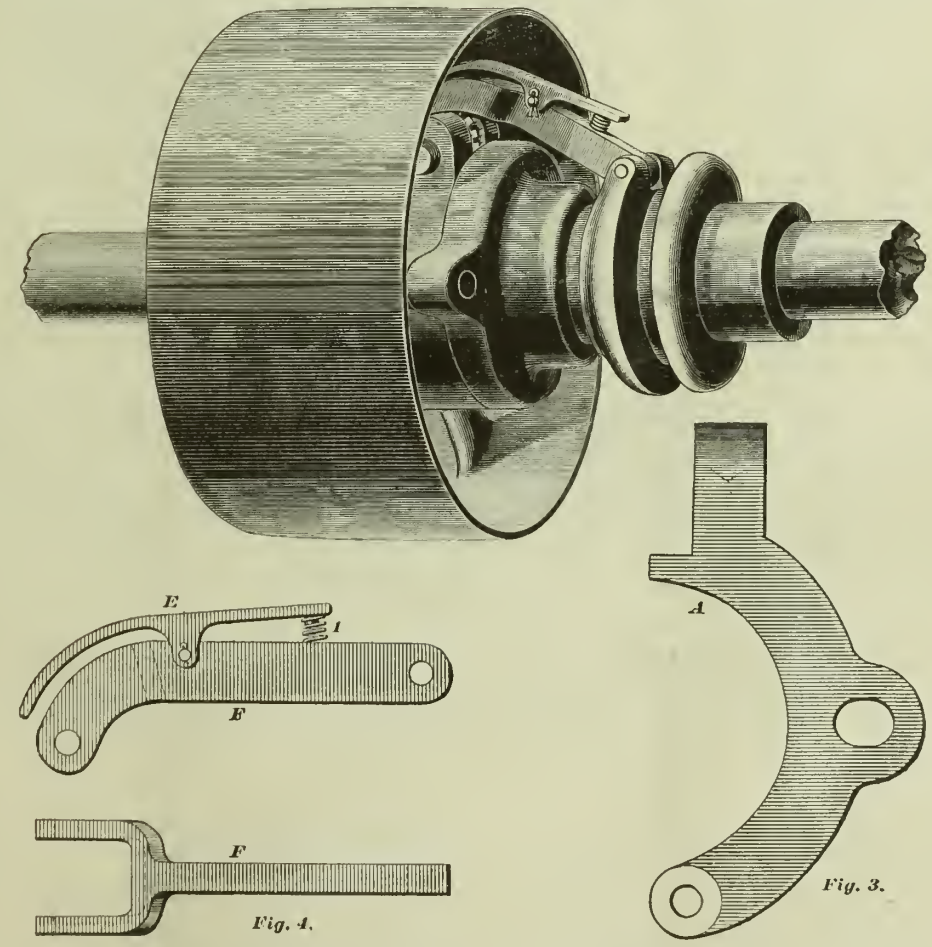


Fig. 4. Fig. 3.

NEW PULLEY CLUTCH AND CUT-OFF COUPLING.

NEW "UNDERGROUND" STREET RAILWAY.

An experiment is to be made on the north side of Chicago to test an electric railway scheme devised by Col. J. C. Love.

When the annual meeting of the American Street Railway Association for 1887 was held in Philadelphia, Col. Love was there, and was accorded a hearing, but he could not make himself understood. In fact he was so emphatic in his statement that he had the grandest electric railway system yet devised, that he failed to go on to explain its points, and he collapsed in a strange way. The colonel is on deck again.

We are now informed that in the course of a few weeks the Love electric railway system will be in operation near the northern limits of the North Chicago street railway system. Mr. C. T. Yerkes, the well-known street railway president of Chicago, will meet the Love company half-way to enable them to show what their electric railway system with the wires underground, will do.

The trial line, which is one and one-half miles in length, includes four curves and two railway crossings, and is in the suburbs, where it will have the severest test with mud, snow, and ice. Mr. Yerkes, who is anxious to test the efficiency of the patent, gives the right of way on his tracks and pays the cost of the seventy-five pound rails with which they are to be laid. The Love company has appropriated $200,000, it is said, for the purpose of making this demonstration of their patent.

Albert G. Wheeler, general manager of the company, informs us that the patent had been subjected to the examination of the best electrical experts in the country, by whom it had been enthusiastically approved. "We don't call this test an experiment but a demonstration," said Mr. Wheeler. "We have passed the experimental stage long ago and are now getting ready to demonstrate to the world what we can do." He said the contracts for the work had already been let, the one for the slot-rail going to Carnegie of Pittsburg and the general iron work to the Bouton Foundry of Chicago, while the contract for the road construction went to Messrs. Wight and Meysenburg. Work will begin October 10, and six weeks later the company hopes to have cars running.

Mr. Wheeler claimed that the first cost of construction of the system will be considerably less than that of the cable system, and that it will cost less than one-third as much to maintain and operate it.

The Love Electric Traction company is incorporated with $10,000,000 stock. Its officers are: P. C. Hanford, President; John A. Roche, Vice President; John G. Shortall, Treasurer; and Albert G. Wheeler, Secretary and General Manager.

Great victories can only be enjoyed by those who fight great battles.

THE NEW SHORT RAILWAY GENERATOR.

It is an event well worthy of notice when one of the great electric railway manufacturing companies puts upon the market an entirely new type of generator. This is particularly true when to genuine novelty in design is added principles of construction which are so evidently well adapted to their purpose, that the advance upon existing methods is at once evident, even to the uninitiated. The Short Electric Railway Company has just brought out the first of a series of railway dynamos, which are admirable in every respect. They are massive in form, beautifully simple in construction, and are marked by the mechanical perfection and finish for which the Short company has always been noted.

The illustration gives an excellent idea of the 150 h. p. generator, capable of delivering in continuous service 225 amperes at a pressure of 500 volts equivalent to a total electrical output of 112,500 watts, and having in fact a reserve capacity above the normal of at least 30 per cent in both current and voltage.

The great field magnet frame is one of the largest and most perfect single castings ever made for electric work. It weighs over 8,000 pounds, and nothing but the softest and purest iron is used in the melting pots. It is annealed very slowly in the moulds and when finished is so soft that it can easily be indented with a hammer. For properly finishing up the casting it was necessary to build a monster planing machine—one of the largest to be obtained.

To this heavy frame are bolted eight field magnets carrying the shunt and series coils and provided with pole pieces of peculiar shape arranged for side presentation to the armature and so disposed as to make a powerful and almost perfectly uniform "field of force" within a narrow "magnetic gap" of large diameter.

Within this space revolves the armature which is a distinctive feature of the machine. Its peculiar construction is well known to all who are familiar with the past practice of the Short company, which was the earliest, and for a long while the only prominent advocate of what is known as the "Gramme ring construction" for railway motors and dynamos, but which has lived to see the value of this method of construction conceded by all street railway men, and by nearly every manufacturer of electric railway apparatus, it is said.

Upon a shaft, nine feet long by six inches in diameter, is keyed a massive spider carrying the foundation ring upon which the armature is built up. The armature core is formed of thin sheet iron wound spirally on the foundation ring and riveted firmly together. The outside circumference of the ring is somewhat wider than the remainder, and this portion is milled out into notches forming a modified Paccinotti Ring. The coils are then wound on the core around the hollow ring, the method being such that each and every one of the 200 coils is entirely exposed to the air on all sides, thus securing the perfect ventilation which is obtainable in no other type of armature. The projecting coils are, in fact, a sort of fan, and in standing before the machine the current of air set in motion by the armature can be detected ten or fifteen feet away. As a consequence both armature and field run cool and it is almost impossible to burn out a coil even with heavy overloads. Moreover, the destruction of a single coil does not affect adjacent coils, and it is even possible, in case of necessity, to run the machine for several days without rewinding a burned out coil, a feat absolutely impossible with any type of Siemen's armature. A burned out coil can be wound by any good mechanic at a cost of two or three dollars, and a half day's labor. One of the most noteworthy features of the armature is its large diameter, viz: 36 inches, which is also, by the way, the diameter of the pulley usually employed with high speed engines. In seeing this magnificent generator in operation, one is struck with its anology to the Corliss engine, the large armature and pulley revolving at slow speed seeming like the great flywheel of a Corliss, in comparison with which the long narrow drum armature of other dynamos is analogous to the high speed type of engine. The center of gravity is low and the machine runs smoothly and quietly.

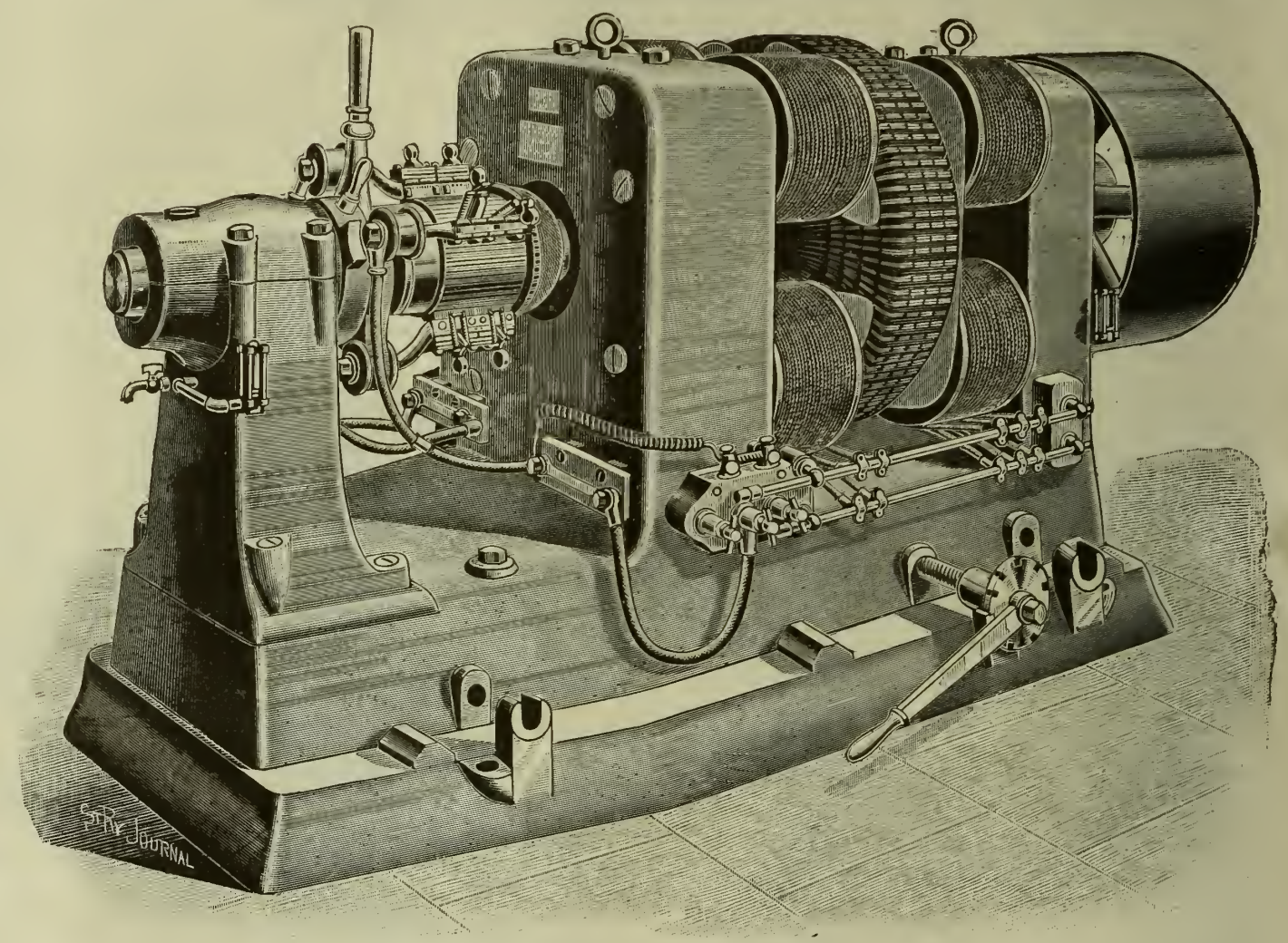
The details of construction are carefully worked out. The armature shaft runs in large self-controling and self-oiling bearings, the lubrication being accomplished by rings carried by the shaft and drawing oil from a reservoir in the usual way. The height of the oil is indicated by the little sight glass on each box. At the commutator box is also found an adjustable ball bearing thrust collar containing several hundred balls, and so arranged as to carry the armature thrust in either direction without the slightest heating. This is an entirely novel feature of this class of machinery.

The commutator is carefully built and unusually large in diameter, viz: 20 inches. It has 200 bars, so that the pressure between two adjacent bars is very small and the sparking *nil*. The brushes are four in number and are carried by two independent collars and sets of brush holders. In order to secure perfect adjustment at the neutral points, multiple carbon brushes are used. The terminals of the field coils are carried to two heavy bars, held securely in place on each side of the base of the machine. The plan of connections is simple and in plain sight, and the machines are so exactly duplicates of each other, that there is no necessity for complicated "shunt spools" or other adjusting devices beyond the ordinary field rheostat box.

The dynamo is placed on a heavy foundation plate and moves on V-shaped rails by means of an ordinary ratchet and screw. The electrical properties of the machine are quite as noteworthy as the mechanical. The magnets always work far below the saturation point, even at heavy overloads. The compounding has been so carefully calculated that the pressure "curve" is a straight line, passing from 500 volts at no load to 525 volts at full load, with speed maintained constant at 500 revolutions.

The Short company is building this type of generator in five sizes, viz: 75 h.p., 150 h.p., 300 h.p., and 500 h.p. The last named size will run at about 100 revolutions, and will be connected direct to a vertical compound engine, thus doing away with all belts and shafting. It is probable that even larger sizes will be built later on, to accommodate the heavy railway work which is immediately in prospect.

The Short company is certainly to be congratulated upon the bold and advanced steps which it is taking in street railway work. Being in a position to devote its entire attention to railway apparatus, it has exceptional opportunities and every inducement for perfecting each detail, and its friends look, with the utmost confidence, for a brilliant and successful career, built upon a foundation of thoroughly reliable apparatus and a reputation for enlightened management and honorable dealing second to no company in the field.



Short Electric Railway Generator.

"STEPHANITE."

Several experiments with a new aluminium flux called Stephanite was carried out at Leeds recently. It is pointed out that the addition of metallic aluminium to iron and steel in a molten state greatly improves their quality, but the high cost of the metal, the impossibility of using it in a blast furnace, owing to its easy volatilisation, and the great difficulty of obtaining a perfectly uniform alloy with the iron or steel in the crucibles, had so far limited its use, and stood in the way of generalising its employment in the iron industries. These difficulties, the promoters say, promise to be overcome by the patent flux; composed of alumina and emery, which they are now introducing. It contains about 70 per cent. of alumina. In its natural state this flux is not volatilisable, like the refined commercial aluminium, but in a blast cupola or reverberating furnace it gives off its metallic gases or vapors, which unite with the iron, for which they have great affinity, and which acts as a condensing agent, whilst all the impurities go to the liquid slag and are drawn off in the usual manuer. Metal

manufactured by means of this flux, it is claimed, works equally well under the hammer with the most malleable wrought iron, and will harden up to the hardest steel. It is also stated that the metal will work over and over again, becoming hard or soft at the will of the operator; and tests have proved that in its soft state it will stand a tensile strain of 38.8 tons per square inch. Another point upon which stress is laid is that the use of flux causes the iron to flow in a much more liquid state, and to remain in that condition a considerable time longer than by the ordinary process, thus preventing blow holes and faulty castings. By means of this invention, the promoters affirm, iron-founders will be able to make their own steel castings, independent of steel works, by simply melting scrap steel in their own crucibles. The cupola was charged in the ordinary way with common pig iron and coke, and then the flux, which is in the form of briquettes, was added. In due course the molten metal was run off and several castings were made. Some of these were immediately chilled and examined by the experts present, who considered the experiment had been successful. It may be added that about eighty pounds of the flux is required for every ton of metal.—*Mechanical World*, London.

INCREASED POWER WITH THE SAME BOILERS.

The owners of the two large English mail steamers were very desirous of increasing the power, to obtain more speed, but they could not enlarge the boilers externally nor alter the engines. The owners applied to an eminent engineer to advise them. That gentleman did so. The heating surface of the boilers was increased so much that the owners got the power required, and this was accomplished by reducing the diameter of the tubes and increasing their number. Therefore, this added heating surface gave increased steam.—*The Engineer*.

Everybody is troubled with too much change—change of weather.

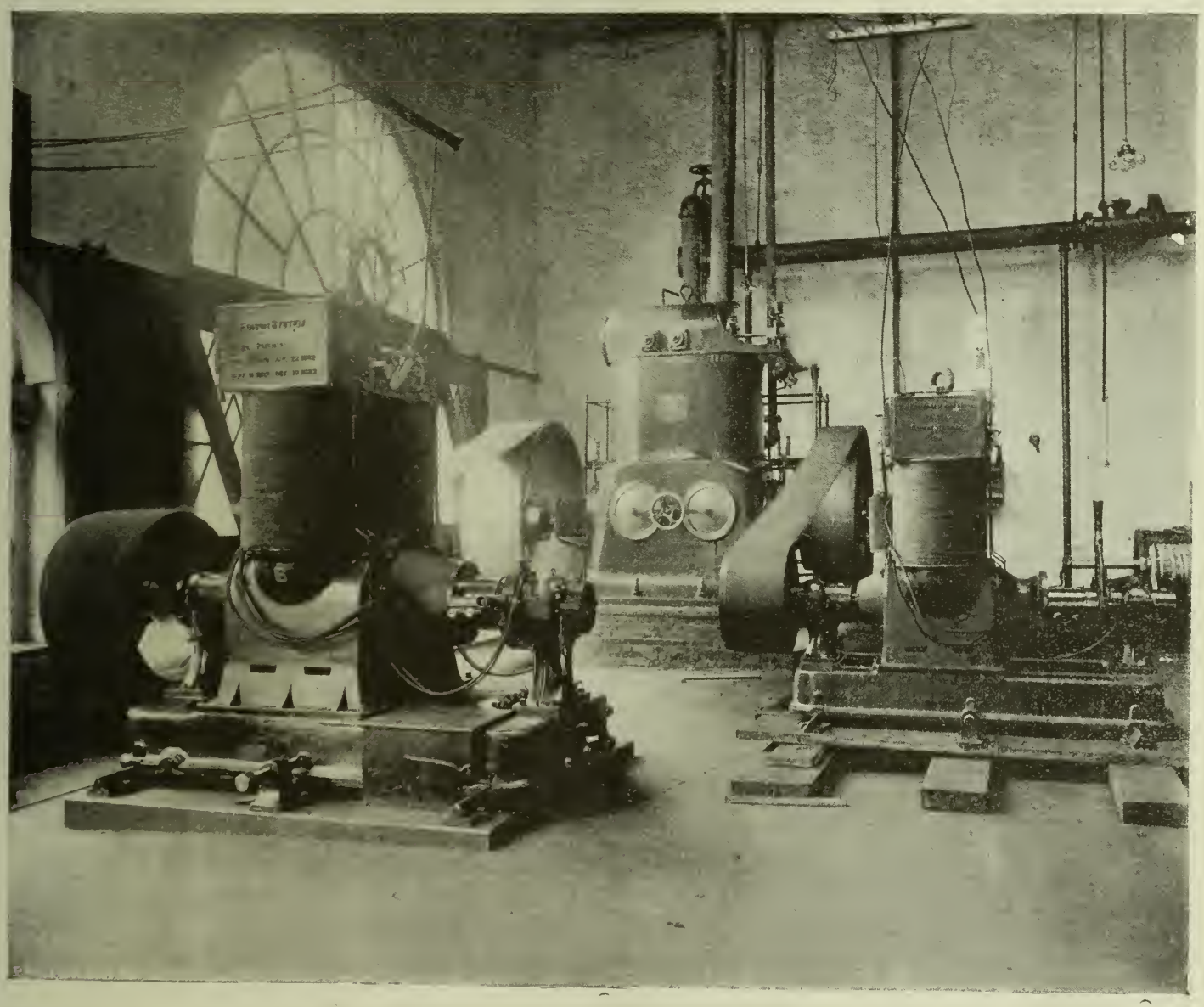
WESTINGHOUSE AND EDISON AT LAST WORKING IN HARMONY.

We illustrate in this issue an example of the direct-belted dynamo in the system of subdivided and independent power now regarded by users of electrical machinery as more readily offering immunity from accident.

The plant shown is complete in itself, and is the first of a series in the station of the Federal Street and Pleasant Valley Electric Street Railway Company, Allegheny, Pa., intended to gradually replace their old complex system of centralized power with all its attendant evils of countershafting, clutches and belting.

The engine is an 18 and 30x16 Westinghouse compound, whose governor was recently the subject of interesting experiment on rapidity of adjustment with instantaneous changes of load.

As originally intended, the combination consisted of a single 225 watt Edison dynamo belted direct from the engine; but the imposition of a second dynamo on the engine, with increased steam pressure on account of the continued trouble with the other system, indicates the success of the change.



New Power Installation of the Federal Street and Pleasant Valley Electric Street Railway Company, Allegheney, Pa.

SPEED OF THE STEAM LAUNCH "NORWOOD."

On the 19th inst. a small steam launch, called the "Norwood," ran a race with one of the fast Sandy Hook boats—the "Monmouth"—down through the bay to Sandy Hook, beating her large rival very handsomely, and developing such remarkable speed as to attract very general attention.

The next day about all the newspapers appeared with accounts of the run, in which the statements were made that the boat had been designed and built by C. D. Mosher, of Amesbury, Mass., a year ago, but had not developed the required speed until after being altered considerably by others. This seems to call for a statement of facts by us, says the *American Machinist*.

In our issue of Sept. 18, 1890, we published some account of this boat, in which we said that at a preliminary speed trial she had shown a speed of 30 miles an hour, which, if true, would be at least as fast as the speed claimed during her run of the 19th, and, in fact, somewhat faster than there is any positive evidence of. To substantiate our original statement, and also as a matter of justice to Mr. Mosher, we append a copy of a letter, the original of which we have seen:

Amesbury, Mass., Sept. 10, 1890.

This is to certify that on July 8th, 1890, I was one of the persons on board at the trials of the steam launch "Norwood," built by Mr. C. D. Mosher, of Amesbury, Mass., and that during a two hours' run she did develop a speed of thirty miles per hour over the Wannesquam Boat Club course, and that she did make one mile in one minute and fifty-eight seconds, and this speed agreed by the watches of each of the gentlemen aboard.

(Signed) C. F. Tibbetts,
Amesbury Manager *Newburyport News*.

George C. Perkins,
Engineer Electric Light Station, Amesbury.
N. S. Hort.
Dealer in Windows and Blinds, Amesbury.
C. H. Folsom,
137 Green Street, New York City.

The evidence seems to be pretty conclusive that the boat has not only previously made considerably above her contract speed of 25 miles per hour, but that while in the hands of her builder she made better speed than was made during her recent run to Sandy Hook. Nearly a year ago a race with the "Monmouth" had been arranged for, and after some preliminary dock trials, in which the machinery had been found to work perfectly, Mr. Mosher went on board the boat to engage in the race, and found that a rock shaft was twisted in such a way as to throw the high-pressure valve out of adjustment, and he could not make repairs in time for the run. Mr. Monroe, for whom the boat was built, was on board the "Monmouth" with some of his friends, and of course was considerably disappointed at not seeing the launch. A bill of sale had previously been made, and Mr. Mosher has not been allowed on board the launch since that time. According to the contract he was to receive $2,000 bonus for each mile of speed per hour above 25.

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TO WHOM IT MAY CONCERN.

This is to certify that THE AMERICAN ENGINEER, of Chicago, Ill., is the only duly authorized official organ of The American Order of Steam Engineers.
JEFFERSON YOUNG, JR.
Supreme Chief Engineer A. O. of S. E.

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CONTENTS OF THIS NUMBER.

THE N. A. S. E. CRITICIZED.

The Omaha *Bee*, September 2, devotes two columns and a half to the "auspicious opening" of the N. A. S. E. convention. According to this, there were 128 delegates present. They were immensely pleased with Washington Hall. Mayor Cushing who had been announced to come and give an address of welcome, sent a written message instead. In the course of it, a strong point was made in favor of engineers' licenses, saying:

"Next to the physician, the engineer is the most important factor to the people of all nations against loss of life and limb. The physician is not permitted in any country to prescribe for the sick or dying without first having spent years in the study of medicine, and then stand the test of a medical examination and received from learned professors a certificate announcing to the world that the holder thereof is a fit and competent man to go to the bedside and relieve human suffering and save human life. And so it is with the pharmacist. The life of the citizen is too precious and necessary to the state to permit the apothecary to put up a prescription without first having passed an examination as to his competency. Surely the engineer on whose intelligence, ability and sobriety depend hundreds of human lives daily, should be as well skilled in his profession as the physician and druggist are in theirs, and should stand the same relative test as to fitness."

Directly after the formality of replying to the mayor's "address" (by proxy) and the reading of the minutes were over, a visit was made to the smelting works.

In the afternoon the committee on credentials stated that 94 delegates and two alternates were entitled to seats in the convention. The *Bee* says:

"The afternoon session was a stem-winder in its way, chiefly because a protest was entered against the seating of Mr. Pratt of Cincinnati. The report of the committee on credentials engendered a lively fight. The struggle with parliamentary rules was something surprising to behold, and the president was tickled half to death when he found himself alive after the adjournment of the session. He was coached during the melee by Hon. John Fehrenhatch, who has been a member of the legislatures of three states. Mr. Pratt, too, came out with hair on his head, for although he was a long while being born into the convention, he finally emerged there on both feet, clothed in all the rights of a delegate."

The humble appeal made by "the venerable" J. J. Illingworth, in the midst of the trouble, as reported in the *Daily Stationary Engineer*, of Omaha, (Sep. 4,) goes a long way to corroberate the *Bee's* remarks. Mr. Illingworth said:

"Brethren, let me make a word of explanation. I presume that you all know that I am acquainted with parliamentary rules and parliamentary discipline. You all know that this is the first time I ever presided over such a body of men—the first time outside of my own little association in Utica, N. Y., that I ever had the honor of presiding. I know my own short comings. I know that I have hurt the feelings of a great many; but I assure you it has been unintentionally. I have done the best I could do with the light I had and with my shortcomings. I hope you will excuse me, and I stand ready at all times to be corrected whenever I have made any mistake. There is no man living who has not made mistakes in his lifetime. This is one of my mistakes. Perhaps it was a mistake in taking the office, which I am inclined to think now that it is. Therefore, if you will forbear with me and render me that kind assistance which you have given during the year, I shall be very much obliged. (Applause.)

Under the caption "Mixing fun with business" the *Bee* (Sep. 3,) says:

"When the convention was notified of the preparations made to visit South Omaha this afternoon, some of the delegates repented of their inaction and moved that the entire day be devoted to business. It went through with a whoop, and the convention adjourned until 9 o'clock this morning.

"The convention has been in session two days, and about the only work that has been accomplished was to decide to do something to-day. The indications are, however, that there will be music

AN ELOQUENT COMPARISON.

Under the heading "Some Very Busy Engineers," the Omaha *Bee*, of Sept. 4, gives a picture of the N. A. S. E., that is in striking contrast to the reports of the meeting of the Supreme Council of the American Order of Steam Engineers last July.

LOOK ON THIS!

A. O. S. E.

Syracuse Herald, (July 16):—

The members of the American Order of Steam Engineers are workers. On Tuesday they were in secret session from 7:30 o'clock until 3 o'clock next morning. Yesterday they kept at it from half-past 7 until noon, but at 2 o'clock they started on a half-day's outing. About 50 engineers with their ladies went out on the lake, stopping at Pleasant Beach and at Maple Bay, where at 5 o'clock a specially prepared dinner was served to them. They had a very jolly time, but before they came home they had to do some more business. Harry Hohn is one of the youngest members of the order. He hails from Philadelphia, where he worked before he met with the unfortunate accident which deprived him of both of his legs. A party of engineers got together yesterday and decided to start the cripple in a cigar store in Philadelphia. In a few moments nearly $600 was subscribed and the project was an assured success. A fine wheel chair had already been purchased for Mr. Hohn and he has been supported by the order. Most of the excursionists came back to the city on the early trains, for the convention goes into session again this morning at the same time as yesterday and the day before and stays there until all the work is completed.

The *Standard* (next day) says:

After four days of hard work the Supreme Council of the American Order of Steam Engineers adjourned last evening to meet the second Monday in May, 1893, at Chicago. The convention just closed has been the best, in point of attendance and amount of work accomplished, that the order has ever held. Owing to the fact that the next convention is to be held in Chicago during the World's Fair, a much larger attendance is assured.

The above are merely specimens of what the Syracuse papers said about the A. O. S. E. convention: they had nothing but praise. And if the two orders are to be judged by their work, the American Order has done well. Then as to their manner of doing that work, the A. O. S. E. have a chief who kept the proceedings in good order. Look at the picture opposite! And think what is likely to be the result.

THEN ON THAT!!

N. A. S. E.

Omaha Bee, (Sept. 4):—

The Engineers' delegates assembled in the convention hall at 9 o'clock yesterday in accordance with the rules of civil service reform adopted at Wednesday's meeting. That is, some of them did, while many did not get around until an hour or two later, and some failed to appear at all. One thing that is noticeably apparent is the painful but ineffectual struggle that the delegates are having with themselves to make a satisfactory showing in the official report of the convention for the benefit of their constituents, and at the same time to corral all the fun there is going in the way of junkets, excursions, banquets and balls. They protest loudly on the floor against devoting the time that should be taken up in convention work to the pleasures mapped out by the local committee, and demand all sorts of penances in the way of early opening hours and evening sessions, but when it comes to a vote as to whether or not the invitation to go somewhere and back again on a special train they invariably vote to go.

At yesterday's session it was discovered that some of the delegates were upon two or more committees, and as this delayed work several changes and new appointments were made, so as to allow all the committees to be at work at the same time. That virtually meant beginning the convention over again.

Then the method of doing business came in for a roasting, and a score or more of delegates who, deep down in their hearts, wanted to visit the stock yards in the afternoon, but couldn't see their way clear to do so because of Wednesday's action demanding an all day session, hopped on to the local committee for planning to take them away from their work.

As usual the local committee came out on top, and Wednesday's action was rescinded and a motion to devote the major portion of the afternoon to the excursion went through with a whoop. One repentant sinner, however, insisted that a meeting must be held at 5 o'clock, immediately after their return.

An adjournment of an hour was taken to allow the committees time to prepare their reports, and those who were thus left without visible means of employment went down to the machinery exhibit and improvised a number of steam guages for lung testers or allowed the wind from the power fan to fluctuate through their whiskers.

and plenty of it when the preliminaries are all disposed of and new business is taken up.

"The visitors, ladies and all, assembled on the court house grounds at noon and had their pictures 'tooken' in a group.

SUPREME CHIEF JEFFERSON YOUNG CANED

The *Bee. World-Herald* and other Omaha papers of September 4, contain such reports as the following:

"The local council of the A. O. of S. E., (a young and vigorous order of steam engineers), which is officially designated the David Gilbert Council, No.2 of Nebraska, have received a welcome visit from Mr. Jefferson Young, Jr. of Syracuse, N. Y., who is Supreme Chief Engineer of the Order. At the same time the N. A. S. E., another order of steam engineers (confined to men who run stationary engines), are holding what they call a convention in Omaha this week.

"While the National Association of Stationary Engineers were losing themselves in the mazy at Washington Hall last night the members of the David Gilbert council of the other order of engineers were also having a real good time over at the Dellonehotel.

"The American Order of Steam Engineers is a comparatively new engineers' association, but it is growing rapidly. The David Gilbert council of Omaha was organized in May last with fifty-two charter members, and now has a membership of 104. Last night they surprised Supreme Chief Engineer Young at his hotel and presented him with a magnificent gold headed cane, appropriately engraved.

"It was a pleasant impromptu affair, and a neat surprise. At 8o'clock about ninety members of the lodge called at the hotel, and John L. Miller, corresponding secretary of the council, in a neat speech presented Mr. Young with a handsome gold-headed cane, a gift from David Gilbert Council. Mr. Young was completely taken by surprise, but managed to make a happy response, after which he footed a refreshment bill, and the entire party spent several hours in talking "good of the order."

Mr Young walked into our sanctum a few days later, and, surely enough, the gold-headed cane was with him.

"How did it happen, Mr. Young?"

"O, I was never so taken by surprise in my life. When I made my official call on the David Gilbert council, the boys said they would call upon me at the hotel 'to talk over certain matters.' Two or three of them first came to the hotel, and said I was wanted at the telephone. On returning from the 'phone I was confronted with such a large crowd that amazed me. And when they presented the cane I felt paralyzed. They say I made some remarks in returning thanks, but I don't remember speaking a word. I had a good deal to say, but I did not know that any remarks had proceeded beyond my throat, which was very full."

"Well, let's see! Did you hear anything of the N. A. S. E. delegates at Omaha?

"Why, their 'convention' was a mere fizzle. They collected contributions by means of false pretences. They went to the employers of our men, and pretended that they all belonged to the same order. Where Bro. Lennox is employed, a man called for a contribution; but the manager sent to ask Lennox if he belonged to the order that was collecting for a convention? Mr. Lennox said, No. And there was an end of it. Others paid $25 and other amounts without asking their engineers if the representations made by the collectors were all right, and found out, when too late, that they had been fooled. I tell you the Omaha people are disgusted with the N. A. S. E."

And as proof thereof, Mr. Young handed us clippings from the Omaha papers, some of which are quoted elsewhere.

ENGINEER Ernst Miller, engineer of the Chicago, Rock Island & Pacific train, which was wrecked at 105th street, Chicago, on August 23, died September 7, from injuries received in the accident.

A man inhales one pint of air at each breath. While standing, the adult respiration is twenty-two times per minute; while lying down, thirteen. To save your breath, lie down.

REVISED CONSTITUTION OF THE SUPREME COUNCIL, AMERICAN ORDER OF STEAM ENGINEERS.

ARTICLE VII.

TRUSTEES.

There shall be a board of seven trustees, two of whom shall be elected at each bi-annual session of the Supreme Council.

They shall hold office for the term of six years. At each third session there shall be three trustees elected.

ARTICLE VIII.

ELECTION AND TERM OF OFFICE.

SECTION 1. The officers shall be elected by ballot.

If in the first ballot no candidate has the majority of all the votes cast the name having the lowest number of votes shall be dropped and another ballot taken, and so on until one candidate shall receive a majority of all the votes cast.

SEC. 2. All officers except trustees shall be elected for a term of two years.

SEC. 3. The election of officers shall take place at the bi-annual session and in the regular order of business.

ARTICLE IX.

MODE OF FORMING A GRAND COUNCIL.

SECTION 1. All subordinate councils in jurisdiction where no grand council exists shall be under the immediate control of the Supreme Council until the formation of a grand council for that jurisdiction.

SEC. 2. When there are four or more subordinate councils established and in working order in any jurisdiction, they, through the deputy supreme chief thereof, may petiton the supreme chief who shall cause the supreme corresponding engineer to notify each of the councils of that jurisdiction to elect two delegates for the unexpired balance of the year, up to the 31st of December following, on the first meeting night of the council after receipt of the communication.

SEC. 3. The delegates shall be past chief engineers and shall meet at such time and place as may be specified by the supreme chief engineer, and proceed to organize a grand council by electing two past grand chief engineers, grand chief engineer, grand first assistant engineer, grand recording engineer, grand corresponding engineer, grand treasurer engineer, grand chaplain, grand senior master mechanic, grand junior master mechanic, grand inside sentinel, grand outside sentinel and the number of trustees required by the State law, all of whom must be past chief engineers.

SEC. 4. The grand council as soon as organized shall elect one delegate (for each hundred or fraction thereof), to the supreme council as provided in SEC. 2, ARTICLE 2, of the constitution, and the said delegates are hereby declared past grand chief engineers.

SEC. 5. A notice of their organization, together with a list of their officers, shall be forwarded to the supreme recording engineer and supreme treasurer through the supreme chief engineer, and the latter officer shall install or cause to be installed by a deputy supreme chief engineer, the officers elect of said grand council, after which it shall proceed to form a constitution and by-laws for its own government, not inconsistent with laws promulgated by this body.

ARTICLE X.

OF GRAND COUNCIL.

SECTION 1. Grand councils exist by virtue of a charter issued by authority of Supreme Council, or supreme chief engineer during its recess.

They shall conform to the ritual, forms, ceremonies, work, regalias, jewels, traveling cards and certificates, and regulations described by the Supreme Council, in accordance with this constitution and shall (subject to the provision hereof and right of appeal) have exclusive or original jurisdiction over all subordinate councils within its territorial limit, and over the members attached to the same.

SEC. 2. All power and authority not herein reserved to the Supreme Council, is hereby delegated to the grand council, the Supreme Council, however, reserving to itself the right at any time, by proper amendments duly adopted to this constitution, to resume any additional power necessary to promote the well being and harmony of the Order.

SEC. 3. Each grand council shall adopt constitution for its own government and also for its subordinates; which constitution shall be in accordance with the provisions of this constitution, and the laws made in pursuance hereof. The constitution of all grand councils, and all amendments thereof, shall not go into effect until submitted to and approved by the supreme chief engineer or the supreme council.

SEC. 4. Grand councils shall be composed only of past chief engineers, but said grand council may provide for a delegate system, and may limit the rights and privileges of past chief engineers in the floor of the grand council.

SEC. 5. The officers of a grand council shall be as prescribed in SEC. 3 of ARTICLE 9, of this constitution, who shall be elected or appointed as the constitution of the respective grand councils may prescribe, and who shall hold office for the term of one year.

SEC. 6. Charter of grand council may be revoked and grand council suspended by the Supreme Council, or supreme chief engineer during recess, for non-conformity to the work, ceremonies or ritual adopted by the Supreme Council; for disobedience of its legal mandates; for improper conduct.

ARTICLE XI.

OF SUBORDINATE COUNCILS.

SEC. 1. Subordinate councils exist by virtue of dispensation issued by the Supreme Council through the supreme chief engineer, or charters granted in lieu thereof, or directly by the appropriate grand council, but to each grand council, when formed, belongs the exclusive right to issue charters to councils instituted within its jurisdiction.

SEC. 2. Grand councils shall prescribe a constitution for the subordinate councils within their jurisdiction, but the following obligatory rules or principles shall be incorporated into each subordinate council constitution.

(1.) A council shall never consist of less than five members, and shall hold stated meetings at least twice a month, at such an hour as may from time to time be determined upon, provided that each grand council may allow meetings at longer intervals by a regular dispensation.

(2.) Not less than five members shall constitute a quorum for the transaction of business, including one qualified to preside, and if five members only be present no appropriation of money shall be made unless it be by unanimous consent.

(3.) All subordinate councils must work the ritual in full.

(4.) The officers of a subordinate council shall be as provided in the ritual of the Order.

(5.) Nominations for elective officers must be made at least two weeks previous to night of election.

(6.) Officers shall be installed at the first regular meeting in the new time, if unforseen circumstances do not prevent, but no officer shall be installed unless he has fully paid to his council the amount of all dues and claims of whatsoever nature, then accrued.

(7.) All vacancies by death, removal, suspension, resignation, or otherwise, shall be filled in the manner of the original selection, to serve the residue of the term, and officers so serving shall be entitled to all the honors of the term.

(8.) No person shall be initiated into a council of this Order who has not reached the legal age of majority, a citizen of the United States, of good moral character, sound in health and limb, a believer in the Supreme being, with at least one year's active service as an engineer where a license is required. They must hold such license and satisfy the investigating and examining committee of the council to which they apply for admission as to their character and ability. Every application for membership must be accompanied with at least one half of the initiation fee. The initiation fee in no case shall be less than three dollars, and shall include one year's subscription to the official publication of the Order.

(9.) Engineers will pass the age limit (set by the grand council or the subordinate council under the immediate control of the Supreme Council), may be

elected to life membership. They must pass the same examination as to ability in character as an active member, and must present positive proof that they have been in charge of a steam engine at some time in life for at least one year. They shall be entitled to all the rights of active members, except that they cannot hold office or vote at election or upon a financial question, or be entitled to any benefits.

(10.) When a new member has been initiated the corresponding engineer of his council shall forward his name and address to the manager of the official publication at once, accompanied by the sum specified by the Supreme Council.

(11.) Application for initiation must be signed by the petitioner stating his age, residence, and where employed, and endorsed by two members in good standing who are members of the council, which must be entered upon the records and the petition referred to a committee of three for investigation (neither of whom shall have recommended him), whose duty it shall be to report on the character of the petitioner at a regular meeting. If the report be favorable, his name shall be referred to the examining committee who shall notify the petitioner to appear before them at some time previous to the next meeting. They shall examine him thoroughly in steam engineering and report on his ability at the next regular meeting. The petitioner shall then be balloted for by secret ball ballot, and if approved he may be admitted.

(12.) Should two black balls appear against the candidate the ballot shall be renewed immediately. Should two or more appear on the second ballot he shall be declared rejected and no other ballot be taken in his case for the period of six months thereafter.

(13.) At least one week must elapse between the date of application and initiation of the candidate.

(14.) Each subordinate council shall have displayed at all meetings a United States flag.

(15.) Any member who shall desire to withdraw from the council to which he belongs must pay all his indebtedness, and procure from the financial engineer signed by the chief engineer a withdrawal card at a cost of not more than fifty cents. This card must be placed in some other council, or returned to the one that issued it within six months after its issue or the holder shall cease to be a member of the Order.

(16.) To secure removal of the card he must pay all dues for the time he has held the card.

(17.) Any brother of the Order in good standing desirous of becoming a member of another council, shall make application as in the case of an initiated person and accompany the same with his withdrawal card from the council of which he was last a member, or the card granted by the grand council in lieu thereof, which shall be referred to a committee of three, whose duty it shall be to report as to the standing and qualifications of the applicant at a regular meeting. The brother shall then be balloted for by secret ball ballot as in the case of an initiate. Any brother who may have lost his card can have the same renewed by applying to the source from which it emanated.

(18.) Any withdrawal card may be revoked by a council granting the same or ordered vacated by the proper grand council, or grand chief engineer at any time for cause appearing, and when so revoked for the purpose of impeachment or trial, the person holding the said card becomes subject to the council that issued the same in so far as concern said impeachment or trial. Refusal to comply with proper citation in this connection shall constitute contempt.

(19.) A withdrawal card can be renewed if lost or destroyed accidentally, and satisfactory evidence adduced from the holder and applicant by the council having granted the same, and upon such times as the council may determine.

(20.) Each subordinate council shall have a seal with proper devices which shall be affixed to such cards as well as to all official documents emanating from the council.

(21.) A member who is one year in the arrears shall be declared suspended, provided said member is not under charges.

(22.) Councils shall provide for carrying to effect the beneficial character of the Order by providing for the payment of weekly benefits in case of disability, and funeral benefits in case of death of a member. The weekly benefits shall not be less than one dollar per week. In case of death of a member they must pay at least one dollar per member of the council.

(23.) Any subordinate council that shall assist the member of another council in sickness or distress shall keep an account of such expenses, and shall forward a bill for all to the council of which the sick or distressed brother is a member. But it shall be the duty of all subordinate councils before giving aid to telegraph the corresponding engineer of the applicant's council for a report of his standing. No benefits shall be charged in excess of that allowed by the council of which the applicant is a member.

(24.) Each subordinate council must keep a book of records, giving in detail the experience of member as an engineer, and it shall be in the care of the examining committee, but under the direct charge of the chief engineer. *This book must not be removed from the council chamber.*

(25.) All members of the Order in good standing have a right to enter any subordinate council, or to visit the grand or Supreme Council while such bodies are in session, and they shall not be denied that right so long as they act with decorum.

(26.) Any member of the Order who shall by talk or otherwise injure a brother member shall be suspended or expelled.

(27.) Any member of the Order who shall be guilty of intoxication while in the engine room shall be suspended or expelled.

(28.) Any member of the Order who shall secure a position through the influence of the Order or a member thereof, and shall while holding such position allow himself to become in arrears shall be expelled.

(29.) Any member of the Order who shall know of a brother sick in distress or dead, and shall fail to report it to the proper officers at once, shall be fined, suspended or expelled, as his council may decide.

(30.) Any member who shall know of a vacancy or a position about to be vacated, and fails to report the fact to the proper officers shall be fined, suspended or expelled, as his council may decide.

(31.) Any member who shall give a position to an engineer not a member of this Order when there is a member out of work who is qualified to fill the position, shall be suspended or expelled.

ARTICLE XII.

Of Delinquent or Defunct Councils.

Section 1. Any grand or subordinate council may be suspended or dissolved and its charter or dispensation forfeited to the Supreme or proper grand council.

(1.) For improper conduct.

(2.) For neglecting or refusing to conform to the constitution, laws or enactments of the Supreme or grand councils or the general laws and regulations of the Order.

(3.) For neglecting or refusing to make its returns or for non-payment of dues or for taxes to the Supreme or its proper grand council. But the charter or dispensation shall not be forfeited in either of the above cases until a council shall have been duly notified of its offence by the Supreme or proper grand corresponding engineer and suitable opportunity be given to answer the charges made against it.

(4.) For neglecting to hold the regular stated meetings as provided by law without a proper dispensation therefor, or unless prevented from doing so by some unforeseen circumstances.

(5.) By its membership diminishing so that less than a constitutional quorum may be left.

ARTICLE XIII.

Quorum of Votes.

A majority of the grand council shall constitute a quorum to transact business, and a member of the grand council when returns for the year and supreme delegate tax have not been paid regularly, and annually forward to the proper supreme officer on or before the first day of May, prior to any session of the Supreme Council, shall in no case be entitled to vote, either being an officer or supreme delegate.

ARTICLE XIV.

Revenue.

Section 1. Each grand council shall pay to the Supreme Council the sum of twenty-five dollars for a charter.

Sec. 2. Each subordinate council organized in States where there is no grand council shall pay the sum of twenty dollars dispensation fee, and they shall be entitled to one ritual and secret work.

Sec. 3. Each grand and subordinate council shall pay for supplies, such sum as may be fixed in the by-laws of the Supreme Council, and all work or supplies so ordered must be paid for when ordered.

Sec. 6. When a subordinate council is organized by the supreme chief engineer in the State where a grand council exists, twenty dollars of the charter fee shall be collected by him and paid over to the Supreme Council for expenses in organizing.

ARTICLE XV.

Mileage.

The Supreme Council shall pay the mileage and necessary expenses of its officers and delegates to and from and while in the supreme session unless otherwise provided for. The mileage shall be at the rate of three cents per mile, and three dollars per day during the actual session of the body.

ARTICLE XVI.

Regalia.

The regalia of the Order shall be a ribbon badge. The design shall be as follows: For the Supreme Council, American eagle over bar of gold, the letters A. O. of S. E. on bar, color red, two gold tassels and gold fringe, the rank of the officer, the United States flag and the seal of the Order on the ribbon. Grand councils, eagle over bar of gold, the letters A. O. of S. E. on bar, color white, two gold tassels gold fringe, rank of the officer on the ribbon, United States flag; and the grand council seal subordinate council, color blue, officers plain bar, A. O. of S. E. on bar, two silver tassels, silver fringe the rank of the officer, name and number of the council.

A MOUNTAIN OF NEARLY PURE IRON.

Large quantities of nickel in South Georgia, and a mountain of wonderful iron ore in Nevada, are important news items now floating on the surface of the industrial world. A San Francisco dispatch says:

By building thirteen miles of track in Nevada the railroad men, who have controlled that state only to squeeze every dollar out of it and choke its resources to the last gasp, could furnish to all the iron furnaces in the United States all the iron they could use at the mere cost of transportation and 25 cents a ton for mining. Thirteen miles from the Central Pacific line there is a mountain of ore that is 98 per cent pure iron, and it can be run into pig iron in any ordinary furnace. Some of the ore has been smelted in the railroad shops at Sacramento and found to be of the best quality of iron. According to the Winnemucca *Silver State*, the quantity is so great that the assessment work necessary to hold the number of claims that might be located on the mountain would produce enough iron to build a half a dozen railways from San Francisco to New York. But nothing is being done to develop mines on the mountain, and there are no indications that the railroad people will do anything to increase the business or value of that part of their line which runs through Nevada, and upon which the government holds claims that are payable out of the net earnings.

Near Riddles, in Southern Georgia, is a 1,400-acre tract that contains large quantities of nickel. It is owned by San Francisco men, and the United States government is trying to buy it because nickel is wanted for the making of nickel steel to be used in armor plating for war vessels. A mining firm is also negotiating for the property, and it is not known which bidder will get the tract.

A German biologist says that the two sides of the face are never alike. In two out of five the eyes are out of line; one eye is stronger than the other in seven persons out of ten, and the right ear is generally higher than the left.

DEATH OF GEORGE W. MCKEE.

Just as we are going to press we have received news of the death of Mr. George W. McKee, the respected father-in-law of Supreme Chief Engineer Jefferson Young. He was in his 83rd year, and was a retired iron merchant, having been engaged in that business in New York for many years as member of the firm of McKee and Judson. After retiring from business he lived on his farm at White Plains, N. Y., where he has since resided up to the time of his death. His demise was not entirely unexpected, as he had been paralized and confined to his bed for about three years past.

Mr. McKee was a prominent member of the Methodist Episcopal Church, being for many years a trustee of the old Carlton Avenue M. E. Church of Brooklyn, N. Y. He gave active and financial aid to the building of the new church, known as the Simpson M. E. Church, which superseded the old Carlton avenue building. He leaves a widow, about his own age, who has been confined to bed for about a year, and is a great sufferer. A son and three daughters, of which Mrs. Jefferson Young, Jr., of Syracuse, N. Y., is the eldest, are left to mourn the loss of an affectionate father.

Our sincere sympathy is extended to Mr. and Mrs. Young in this, their sad bereavement.

CORRESPONDENCE.

Corliss and Slide Valve Engine.

To the Editor of the American Engineer:

Sir:—I see by your issues of August 29th and September 5th, that the Corliss men are still in the field. I thought they had died off, not having heard anything from them.

The Recording Engineer speaks of the steamship that left New York and broke down its old slide valve, but admits that it really broke the valve stem. Now, is that a fair way to judge the slide valve? The stem on any valve is liable to break when the ship is in a heavy sea and gets to racing. As all sea-faring men know that it is an awful strain upon the engine, because when steaming against a head sea she throws the screw out of water.

Now, Mr. Recorder, did you ever see a corliss valve used on an ocean steamship? That would be a splendid rigging for our ocean steamers. Think of a ship standing a northwest gale off the Western Islands, throwing first one end and then the other out of water, the engine running away one moment then almost brought to a stand-still the next, what would become of your pretty Corliss valve gear? I am afraid there would be more money collected for salvage than all the lines put together are worth. The most popular valve on ocean steamships to-day is the "Old Slide Valve."

The Recorder states that six years ago an electric plant in the city of Philadelphia put in a new slide valve, and after one year threw her out. That is a very poor argument to use against the "Slide Valve." I know of a number of engines, automatic and otherwise, that have been thrown out and replaced by other makes, the owner claiming that they were not worth anything. Did the makers of those engines that were thrown out go out of business? Oh, no, they kept on building the same engines. I can cite cases where a number of the best makes of engines have been thrown out through ignorance. Now, he speaks of a long run that was made by a Corliss engine in an electric plant, 286 hours. Why, bless your heart, I know an old slide valve engine that runs continuously for four months without one single shut down, day or night, during the entire time, and all she needed at the end of that time was to take up a little on her brasses. Don't talk long runs, because the slide valve can show longer runs, without stopping, than any engine on earth. My old gal runs from 6 a. m. Monday morning until 12 p. m. Saturday night, and has been doing it for years. It does not require, at an average, over one hour each Sunday to keep her up to the mark.

"Old Slide Valve" is not afraid of going into figures, but as he was first to start this controversy, he thinks it a duty of the Corliss men to prove, by figures, the superiority of the Corliss over the Old Slide Valve. I have called for figures time and time again and I have called for cards, and I have promised when these figures are presented and cards shown, that I would produce both figures and cards that would knock all the Corliss men silly. So, bring on your figures and you will find that I am ready to answer them.

Now, as to this other fellow, who signs himself "Old Corliss," and says that I can't prove that 60 m. e. p. is economical. It is not my place to prove anything of the kind. I have made the claim that I run on this pressure. Now, if I am not right, why don't they jump on me and show me why I am wrong? No, "Old Corliss," ten days is not long for repairs on a Corliss engine, because when they do smash up, they make a big one, and the devil is to pay. But I agree with "Old Corliss" in saying that I would like to see all the boys speak up on this subject. Let there be a merry, friendly war on the subject, and perhaps we can draw out points on both sides of the question that will be very interesting to all. As for myself, I stand ready to back up every assertion that I have made that the Corliss engine is simply a new fangled fad built for ornament and easy running, with a lot of gingerbread work hooked on, that is entirely useless and as claimed in the first, I still claim that the Old Slide Valve is the cheapest engine in the long run. Its first cost is very much lower, its repairs nominal, its age is much longer than the Corliss. The Corliss may save a small amount of fuel, but when you take into consideration its first cost, its expensive repairs and its short life, I say for one, and I think for thousands, that the best of all engines for common every-day hard usage, is the

Old Slide Valve.

Editor, American Engineer:—

Sir:—In reply to Bro. Corliss, Old Reliable wishes, in answer, to say, when asked how he knows the Slide Valve is doing the most work, that it is because the engine is running a factory twice as large as the other; the building is twice as large and has over twice as much machinery to run.

For the benefit of the brother, the first chance I have I will get cards of both engines for him.

Next, about the steamship at sea, with the broken valve stem, etc. Now he has gone to sea, I will answer him by asking a question: In 1840 Mr. Samuel Cunard started the famous steamship line which bears his name with four vessels, Britannia, Acadia, Caledonia, and Columbia, all four side-wheelers having large side lever engines with slide valves. The engines ranged 90″ cylinders, with 9′ stroke, and 100″x10′ large slide valve. When worked by hand it had a large wheel like a pilot's wheel, taking four men to move it; with steam on they run side wheelers for 20 years before they adopted screws instead, first with compound and after triple expansion engines. In 1850 Mr. E. K. Collins started the famous Collins line of steamers; his engines were built in New York, and instead of slide valves, had poppet valves; they were the first side lever engines with poppet valves that crossed the Atlantic, and it was quite a curiosity to the English to see her large engines handled with one man easily.

Now, Mr. Editor, the Cunard has been running their line of steamers for 50 years, and in that time lost two steamers, one between '40 and '50, and the other, the Oregon, a few years ago, near New York, but lost no lives. They have the best record of any of the lines crossing the Atlantic, and their engines are all slide valves; and during all that time they never had any break downs, while the "old reliable" has been doing the most severe duty.

The steamer Baltic, of Collins' line, in '53 made the best time across from Liverpool; in '56 Cunard built the Persia to beat the Collins line. The Persia and Pacific left Liverpool within a few days of each other; the Persia made her first trip in 12 days; the Pacific was never after heard of, her fate not being known. The Arctic, a year before, sank in a collision with some French steamer during a fog off New Foundland banks, and something like 250 lives were lost. These two disasters broke up the Collins line. At that time these were the only lines running across the Atlantic. If he can bring a better record for a Corliss I would like to hear it.

There was a stunner that I was going to mention, but the record I wanted I could not find handy, so I will leave it out.

In 1856 the Laclede Rolling Mill Co. built their mill in St. Louis; they built a 32″x6′ poppet valve engine which ran and did all the work for twenty years. They then thought they would keep up with the times, and they took out their old engine, and broke it up, and put in a high speed, which gave them a good deal of trouble, by breaking down. They soon took that out and put in two Corliss, with no better results. And their superintendent said that if they had not broken the old engine, they would have taken the new ones out and put the old one back again. As it was, they had so much trouble that they have shut the mill down for good some years back. They have had enough of Corliss. What more can be said!

Yours fraternally,

Old Reliable.

Voluntary Adviser.

To the Editor of the American Engineer:

Sir:—I was thinking The American Engineer was run by a full head of steam supplied by your corresponding engineers; but I see part of its machinery is run by crank. So I feel free to contribute.

While reading a recent issue, I believe I have found an old schoolmate "Old Slide Valve." This is his new name, but that is not the name that we boys and girls called him. His real name is Flint, and truthfully speaking, his face is flinty, but his heart is as warm and tender as a spring chicken. Nevertheless he was highly esteemed as our friend; many are the disputes he has settled on the playground by a few words spoken in a firm, decisive manner and cool forethought, which I see characterize him in these his later years.

And now, my old friend, let me advise you to stand erect and keep an eye open for that recording engineer; for he has the idea that he has dealt a telling blow in his last letter in The American Engineer. Why! To read his account one would think he was married to the Reynolds Corliss engines. You had best send him a little note advising him to hie to the nearest cooper shop, and have two good substantial hoops put on the top of his cranium, thereby warding the sudden expansion that is sure to follow. Perhaps it would be well to also look a little to the governors before adjusting the hoops.

There is still another person we feel interested in, that is, the man that is going to dig that terrible hole in the earth. Please tell him, for me, to feel around the upper story first to ascertain if there are no vacant rooms, and if his time is not fully occupied at present he might make a wheel or two while sitting in our musee.

With malice toward none, and good will toward all, I remain,

Frank Peerman,
706 N. 16th Street, Omaha.

Owosso Council, No. 8, Mich.

To the Editor of the American Engineer:

Sir:—From August 26th to August 30th, I was with the boys in Owossa, Mich., and a right royal reception I met with too,—and completed the organization of one of our most promising councils in this state: "Owosso Council, No. 8." The election of officers resulted in the choice of the following well-known engineers in that flourishing city:

Chief engineer, Andrew Jackson.
First assistant engineer, Enos Crandall.
Recording engineer, Frank Green.
Corresponding engineer, Nelson Yeomans, 920 Sheawassa St.
Financial engineer, Henry Bagley.
Treasurer Engineer, M. Crandall.
Senior master mechanic, Frank Lewis.
Junior master mechanic, Thos. Lennon.
Chaplain, Frank Clapp.
Inside sentinel, George Kaiser.
Outside sentinel, Warren Stoner.

All "A No. 1" and enthusiastic in their praises of the A. O. of S. E., notwithstanding they have the N. A. S. E. right in their midst.

Let us all unite in giving them God speed.

Fraternally, C. M. Baker, G. C. E.

J. D. Rockefeller's Scheme.

To the Editor of the American Engineer:

Sir:—The richest man in America, as Mr. Rockefeller is believed to be, has become a very large owner in the Northern Pacific railway property, and

his possessions on the Pacific slope, especially in Washington, are very great. Mr. Rockefeller has conceived the idea of developing a scheme, with General Russell A. Alger as partner, which will involve the solution of some engineering problems almost as great as those which are engaging the attention of the engineers of the Nicaraguan canal.

Lake Washington, in the State of the same name, is a spring-fed body of water about twenty-five miles long and from eight to ten miles wide, and has a depth of water sufficient to float the largest steamships. Puget sound is but twelve miles distant. Mr. Rockefeller's scheme is, in the first place to build a belt line of railways around the lake, making connections with the great trunk lines running to the east. Next he and General Alger are going to build a canal twelve miles long, running from the lake to tide water. The lake is some sixteen feet above the sea level, and of course this difference of elevation must be overcome by a system of locks. The canal which it is proposed to build will be a genuine ship canal, capable of floating steamers engaged in the China trade.

It is Mr. Rockefeller's idea, and that of those associated with him, that the ocean steamships will come to the sound and, by means of the canal, into this body of fresh water. That will result in the creation of a port of entry upon the banks of this lake, and Mr. Rockefeller is of the opinion that the future metropolis of the coast north of San Francisco may be located there.

The scheme is unparalleled in the history of commercial development. To run by means of a canal from salt water into an absolutely safe harbor of fresh water is to do that which is done nowhere else on the face of the globe.—E. J. Edwards.

A WATER-PRESSURE PUMPING ENGINE.

By John S. Brodie, Whitehaven, Eng.*

Since Mr. Henry Davey, of Leeds, read his paper on "Water-pressure Engines for Mining Purposes" before the Institution of Mechanical Engineers in 1880, the author is not aware of any further published accounts relative to the progress of this important branch of mechanical engineering.

The economical application of water-pressure engines, on a moderately large scale, is almost solely confined to those districts where water in abundance is found at comparatively high altitudes, and which are provided with sufficient storage capacity, either natural or artificial, to allow of an available constant and sufficient flow of water at all seasons of the year. Where such conditions exist, it becomes the primary duty of the civil engineer to utilize and direct forces, which would otherwise run to waste, in any useful application which may be most suitable to the local requirements in each case.

In the case now under discussion, it may be stated generally that the town and district adjacent to Whitehaven are supplied with water drawn from Ennerdale Lake, in the county of Cumberland. The lake is about nine miles from the center of the town, and at an elevation of about 180 feet above the main service reservoir at Whitehaven, into which the water from the lake is delivered. The pipes are sufficiently large to deliver the quantity of water required, and to have a margin for future extensions; and this margin in pipe capacity—or, in other words, the surplus energy in the mains—is utilized for pumping purposes in the manner that will now be described.

The level of the overflow weir at the lake is 369 feet above Ordnance datum, and this level is found to be sufficient for the supply by gravitation of a population of about 20,000 persons. But a further population of about 6,000 is located at a level of from 350 to 500 feet above Ordnance datum, and hence pumping is necessary to supply the latter.

The main service reservoir is situated within a mile of the center of the town, at a level of 186 feet above Ordnance datum; and this supply from Ennerdale Lake, which is, as previously stated, about nine miles from Whitehaven, is delivered into the main service reservoir by two mains, at a uniform rate of one million gallons per twenty-four hours. The water mains are 11 inches and 12 inches diameter respectively at their lower ends, and they are laid over very uneven ground at a hydraulic gradient of about 12 feet per mile.

*In Transactions of the Liverpool Engineering Society.

The pumps in question are situated on a bye-pass from the water mains, within a few feet of the main service reservoir. By means of a suitable arrangement of sluice valves, the water in the mains can either be delivered direct into the service reservoir, or can be sent by way of the bye-pass, to actuate and feed the engines and pumps respectively. It is not considered, in practice, desirable to send the whole of the water *via* the bye-pass when the pumps are working, but the valves are turned down until a head of about 100 feet is indicated by the pressure gauge as being the pressure in the mains. It has been found desirable to adopt this plan of allowing a small quantity of water to pass the partially-closed valve, as it greatly lessens the "ramming" of the water in the mains, with its consequent injurious effect upon the pipes and joints.

This water, then, stored up in the mains at 100 feet of head, is led into the pumping engines, where it is separated into two quantities by suitable brecches pipes, part going to actuate the engines, where, after doing its work and expending its energy, it is exhausted through suitable pipes again in the mains (on the contrary side of the sluice valve from whence it was drawn), and forthwith delivered into the service reservoir for use in the usual manner, as if no pumping had been done. The other quantity of water is taken, by means of suitable piping, into the ram cylinder of the pumps, whence it is delivered into the pump-rising main.

The engines are in duplicate, the motive power water branching from the bye-pass main to each engine cylinder at a head, as already stated, of 100 feet. An air-vessel, 2 feet in diameter by 12 feet in length, is placed on the bye-pass main, before it branches into the engine cylinder. Besides this air-vessel there is a smaller one, 18 inches diameter by 5 feet in length, placed over each valve casing in the engine cylinders. The water is admitted into and discharged from these cylindnrs by equilibrium piston valves, actuated by four-way cocks, which are, in turn, worked by tappets fixed on rods attached to the piston rods. The piston valves and lining are of gunmetal, with phosphor bronze rings. The pilot pistons are also of gunmetal, with leather cup rings and solid gunmetal cylinders, and strong copper pipes for the exhaust and supply pipes.

The engine cylinders are 18 inches diameter and 2 feet 6 inches stroke, provision being made for inserting a brass liner when necessary. The pistons are the usual cast iron type, with cup leather rings.

The pumps are of the double plunger description, 9 inches diameter, with cast iron hollow rams acting direct from the engines. The pump inlet and outlet valves are of solid gunmetal, and are of the equilibrium double beat description, discharging into an 8-inch rising main, on which is placed an air-vessel exactly similar to that on the bye-pass already described.

The air-vessels are automatically replenished with air by means of a small air-pump, the motor piston of which is alternately subjected to the inlet and outlet pressures in the ram cylinders, being connected to each cylinder by small copper pipes with plug cocks, and by similar pipes to the air-vessels.

The pumps deliver through an 8-inch rising main, 2,200 lineal yards in length, into an auxiliary service reservoir at the level of 500 feet above Ordnance datum, or 314 feet above the level of the pumps. But as part of the motive water is conveyed directly into the ram cylinders at a head of 100 feet, the net lift is 214 feet.

Automatic indexing gear is fitted to each pump, so that the quantity of water pumped during known intervals of time can always be accurately ascertained.

The work specified in the contract for the pumps was a minimum of 165,000 gallons in twenty-four hours for each pump; the water-works authority guaranteeing a uniform supply of one million gallons per twenty-four hours at a head of 100 feet. The average performance of the engines during the four years they have been at work has been as follows:—

(*a*) Each pump working separately, 172,250 gallons per twenty-four hours—equal to 4.7 per cent above specified performance.

(*b*) Both pumps working simultaneously, the motive water being the same as for one pump, 170,500 gallons per twenty-four hours.

The lower efficiency obtained by the pumps working together is, of course, due to the increased friction to be overcome in the working parts.

When at work, the variation of the pressure gauge on the inlet pipe does not exceed 5 per cent, while that on the rising main does not exceed 1 per cent—a result no doubt entirely owing to the comparatively large size of the air-vessels, and also to their being always kept fully charged with air.

The pumps were supplied and erected under contract at a cost of £460 ($2,245), no extras being either claimed or allowed.

The engines are located in a suitable engine-room, with cream-colored glazed-brick walls on three sides; timber roof, ornamentally painted inside, and picked slates outside; with encaustic-tiled floor of a highly ornamental pattern. The side of the room facing south is entirely glazed; and, owing to the entire absence of dust, smoke, steam, etc., the place is easily kept in a very clean condition.

No attendance beyond periodical visits for oiling, etc., is required, as the pumps are perfectly automatic; and, as will have been seen from the foregoing description, the motive or driving water, after doing its work in the engine cylinders, flows at once into the main service reservoir, and is used for ordinary supply purposes, and therefore costs nothing for pumping purposes. The cost of the pumps was defrayed out of current revenue, and therefore no interest or sinking fund payments have to be provided.

There remains only, the cost of stores and maintenance, which have amounted to £52 2s. 6 d. ($254) for the four years the pumps have been at work.

The quantity of water pumped in that time, as shown by the engine counters, is 196,612,000 gallons.

The cost of pumping is, therefore, at the rate of .06 of a penny (about one-quarter of a farthing), or one-eighth of a cent for every 1,000 gallons of water raised to a vertical height of 314 feet.

The pumps were erected, and commenced working on the 26th October, 1886, and the above data is up to the 26th October, 1890.

THE CARE OF A BOILER.

The proper care of a boiler is one of the most important things about a steam plant, and yet less attention is commonly given to the boiler than any other part of the machinery. There may be several reasons for this, and one which shows up the most frequently is that the engine with its finished parts and brass oil cups and steady running gives a better chance for display than does the boiler. The engine room seems to be important part of the establishment and the place that receives the most attention, while the boiler is generally located as far out of the way as possible and receives the smallest amount of attention that can reasonably be given it. This is not the case in all plants, but in the majority of them the boiler is neglected, so that more time and attention can be given to the engine and its surroundings, and it is usually noticed that wherever there is a fine engine on which a show can be made, the boiler room will be found quite dirty, most of the apparatus required therein is in an uncleanly condition, more so than should be necessary from the amount of dirt and dust usually made in such places. Where the engine receives the larger amount of the attention, the boiler must of necessity be neglected and usually is, to a considerable extent, and is nearly always the case where the engineer does his own firing. All engineers know that the boiler is the most important piece of machinery about the plant, or at least should receive the greater amount of attention. Owing to the duties required of boiler and engine and the means employed for working them, it is understood that there is a possibility of accidents occurring in a short space of time which may be the cause of the destruction of the whole apparatus. When an engine breaks down, the destruction is usually confined to the one room and is seldom disastrous, for such accidents rarely occur, while anything that may happen to the boiler, and the possibilities are many, may be the cause of a large amount of damage. We have no indicators for

boilers that serve the purpose so fully as the steam engine indicator, and the noises produced are practically indications of the condition of the engine, but in a boiler there is nothing which corresponds to this, for although braces may be loose or broken, rivet heads corroded and eaten off, boiler plates grooved or pitted, initial strains present from the too free use of the drift pin, necessitated by the low price at which the boiler was furnished, crystallized plates, produced partly from the same cause, may either one be capable of causing a terrible accident, which coming as it will, without warning, may make the results most terrible. All these defects have been found in boilers, in some cases before an accident has occurred, but in others only from an examination of the wreck produced and of the fragment left, but in most cases their presence is unknown until the boiler is in a decidedly dangerous condition.

In plants where a fireman is employed a much cleaner fire room is usually found, and, occasionally, the fireman takes sufficient pride in his surroundings to keep the boiler front and other parts exposed to view reasonably clean, and some go so far as to keep all the fittings bright, the ceilings and walls whitewashed, pipes, dome, etc., nicely painted a deep jet black, and an air of tidiness all around. In such a place, it may be inferred, from a casual view, that the machinery of all kinds has excellent care and that the inside of the boiler receives fully as much attention and as close examination as the outside parts which make the show, and this is as it should be.

Some engineers have claimed, with a show of pride, that they have not had their boilers open for over six weeks, two months, or longer, as the case may be, apparently considering that such things are complimentary to their ability as an engineer. In some cases it is all right, no doubt, for any engineer that gives his boiler a careful examination and inspection every two or three months may be reasonably assured of its safe condition for that length of time, providing everything was found as it should be when the last examination was made. The use of mechanical boiler cleaners tends to increase the length of time between which examination of the interior of the boiler is made, as some of these devices are capable of keeping a boiler free from scale for several months time without special attention. But no boiler should be allowed to go so long without careful examination, for a sufficient amount of corrosion can take place within the time to change the condition of the boiler from that which would be considered safe to that which might be positively dangerous and unreliable under ordinary conditions of usage. A practical knowledge of the subject would indicate that every engineer, worthy of the name, who had charge of a boiler, would make a careful examination of both the inside and outside, at least, every month, closely examining all parts for signs of corrosion, grooving or pitting, sounding plates and laps in joints for unusual and unsafe conditions.

The safety valve is a factor that cannot be ignored, and the usual practice of opening the valve or causing it to blow off at least once per day, does not really seem sufficient to be a guarantee that it will perform the duty required of it just at the time it should work to best advantage. A safety valve may readily stick, especially those that are constructed to prevent the steam blowing into the engine room whenever the safety valve performs its duty. A valve of this kind is usually fitted with a cap surrounding the stem through which it is intended to move without friction, and also without permitting an escape of steam around the sides of the stem, and for this reason there is great danger of its sticking, and that without any indications which will call attention. Valves of this kind, whenever inspected, will be found to have the stem thickly covered with mineral matter which has been carried off with the steam and finally adheres to the stem with such tenacity that it can only be removed by filing or sand-papering. Such accumulation enlarges the stem and a similar deposit in the cap often produces such a condition of affairs that to start the valve from its seat, even when the lever is removed, requires considerable of an effort Under such conditions the valve is not corroded to its seat as usually expressed, but the stem and cap are caused to adhere on account of the accumulation deposited from the flow of steam, which carries with it more or less water from the boiler, which in turn deposits the sedimentary matter carried over.

As near as can be judged from what we find, the water in a boiler while in a state of ebullition is covered with scum formed from mineral and vegetable matter introduced in the water, and in some cases oil is also found which is brought in from the exhaust. It is generally shown that when water is carried over with steam, a large amount of this sedimentary matter is carried over also, and frequently a great quantity of it passes through the engine and out of the exhaust pipe, as may be noticed by the streaks of whitewash with which the exhaust pipe is marked. These substances when blown out through the safety valve are what causes such trouble, and to keep a boiler entirely free from such accumulation on the surface of the water would require the frequent use of a surface blow-off, or the constant use of a mechanical boiler cleaner. But as the proper care of a boiler requires a consideration of a number of points that cannot be given a single article we will continue the subject in another paper.—D. Rivers, in *Invention*.

AN INDIANAN'S INVENTION.

G. F. Huttsell, a peach grower living near Salnda, Ind., is having built a boat which he claims will be the beginning of a new era in steamboat mechanism. The craft, now nearly completed, was designed to thoroughly test the practicability of a peculiar gear for a steamboat wheel which he has patented. It is about sixty feet long and will be named Victoria, after his eldest daughter, a beautiful belle of the neighborhood. The feature of the wheel is the vast saving in motive power, and Mr. Huttsell asserts that a two-horse power, applied to the gearing will give as much pressure from the paddles against the water as that of any of the mail boats running between Cincinnati and Louisville.

The wheel and device for the new boat are being cast in Madison, and a number of river men have been impressed with its availability. The principle is that of a flat wheel with pinions that move small cogs on the revolving rod of sidewheels or a stern wheel. It is somewhat similar to a device in use in machine shops for obtaining rapid wheel revolutions. One revolution of the pinion wheel will give nineteen revolutions of the water-wheels, and tests have shown a wonderful pressure thrown against water with a one-horse power.

Mr. Huttsell has been working on this patent for ten years, but has not had the means to build a test boat until this season, when a large peach crop brought him returns which he invested in the boat. It is to cost over $600. He has had several advantageous offers for the patent right, but has refused them.—*Madison Courier.*

Steam pipes have recently been made of ramie fibre, hardened under tremendous hydraulic pressure, and possessing a tensile strength equal to two and one-half times that of steel, says *Invention*. The ramie fibre, or China grass, has the property of being unaffected by moisture; it will not shrink nor swell, it is a non-conductor of heat, it cannot rust, and these features together with its great strength, are all desirable in steam pipes, its utilization in this line being regarded, therefore, as one of the possibilities of the future.

Late developments in electro-photography indicate that it may be possible to take photographs of views located many miles from the camera.

COAL, IRON AND STONE AT THE FAIR.

The Great Industrial Mineral and Metals will Constitute an Important Feature of the Mines and Mining Exhibit at the Columbian Exposition.

In no other department of the World's Fair, perhaps, will be seen a greater diversity of exhibits than in that of Mines and Mining. Not only will there be a dazzling array of diamonds, opals, emeralds and other gems, and of the precious metals, but a most extensive collection of iron, copper, lead and other ores, and of their product; of coal, granite, marble, sandstone, and other building stone; of soils, salt, petroleum, and, indeed, of almost everything, useful or beautiful, belonging to the mineral kingdom. How extensive the mineral exhibit from other countries will be, it is yet too early to know, but the indications are that it will surpass any that has heretofore been made. However that may be, there is no doubt that the mineral resources and products, not only of this country as a whole, but of each state and section, will be of the most complete and representative description.

Chief Skiff, of the Department of Mines and Mining, is confident that this will be the result of the plans which he is pursuing.

Owing to the fact that what has been published thus far, relating to the exhibit of this department, has been almost exclusively concerning gold, silver and the various precious stones and rare collections of minerals, many have inferred, perhaps, that the baser metals and minerals are to receive scant attention. This is far from being the case. In fact, so important does Chief Skiff consider it that the representation of the latter shall be fully commensurate with their surpassing industrial importance that he has determined to organize soon a subdepartment to take special charge of the coal and iron exhibit, and later of that of coal and lead.

The coal industry in the United States is of gigantic proportions, involving the investment of many millions of capital and the subsistence of many hundreds of thousands of people. According to recent census bulletins the output of coal in 1889 alone aggregated 104,576,290 tons, the value of which at the mines was $131,421,172. Fully two-thirds of the states and territories are coal producing. But great as is the annual production of coal in this country, it is insignificant in comparison with the possibilities. Our coal resources are simply enormous. Vast areas of coal measures, thousands of miles in extent, lie distributed between the Atlantic and Pacific and the northern and southern boundaries. Throughout the west and south coal mining is rapidly increasing in importance.

The exhibit of coal at the Exposition, of course, will be qualitative rather than quantitive. Not only will the different varieties of coal, which the different localities produce, be shown, but chemical analyses of each and the results of tests determining economic value and adaptability to various uses. The coal resources of the different states and sections will be shown by geological maps and drawings showing configuration, stratification, etc., which will render apparent the extent and accessibility of the coal beds and veins. For example, it will be shown that coal measures of varying thickness underlie a great portion of the state of Texas—some forty or fifty counties—and that, although the coal production of Texas has thus far been comparatively small, the supply is practically inexhaustible, and that much of the coal is of excellent quality. Chief Skiff is enlisting the co-operation of large coal exchanges and corporations, and expects to have a very extensive and complete exhibit.

So, too, as regards iron. The most strenuous efforts will be made to have an exhibit worthy of that great branch of industry. This country is now the first nation in the world in iron production, having recently forged ahead of Great Britain, its only real competitor. Our production of pig iron now exceeds 10,000,000 tons annually, or nearly four times what it was ten years ago, and the production of steel now aggregates about 5,000,000 tons a year, a growth of nearly 300 per cent. in the decade. The development of the iron resources of the Southern states has been especially great and rapid. The display at the Exposition will be prepared and collected under the fullest appreciation of the magni-

tude and importance of the iron industry. There will be shown all the many varieties of ores, with full data as to the extent and location of their beds, the analysis of each ore, and, so far as possible, the different processes of treatment in the manufacture of iron and steel.

Another exhibit which will be very extensive and varied will be that of building stone. Granite, limestone, marble, sandstone and bluestone, in scores of varieties and scores of colors, will be shown by the finest specimens procurable. Nearly every state has quarries of native material of excellent quality. From one to half a dozen of the twenty or more recognized varieties of granite, for example, are quarried in twenty-eight different states, Massachusetts, Maine, California and Connecticut being the largest producers. The value of the granite output in 1889 was $14,464,095, an increase of more than $9,000,000 over that of 1880. Limestone is quarried in almost every state, Pennsylvania and Illinois taking the lead. The value of the output in 1889 was $19,095,179. This is exclusive of the output of marble, which, as is well known, is a species of limestone, the quarrying of which in a number of the states is an important and extensive industry. Sandstone, including bluestone, was quarried in 1889 to the value of $11,758,081, nearly every state being a producer. The exhibit of building stone, Chief Skiff intends, will be given the importance it justly demands. Thousands of specimens, many of them highly polished, will be shown, and accompanying each will be the results of tests made to determine strength, durability and other merits as construction material. The exhibit which will be made in the Mines and Mining department will, it is believed, mean very much in the matter of rapid development of newly discovered mines and quarries, and the attraction of capital to many which, through lack of it, have been but little worked.

THE DIFFERENCE BETWEEN ENGLISH AND AMERICAN SPEECH.

There is quite a difference in the English and American speech, though we are not aware of it to any extent until our attention is called to it. The nomenclature of business is apt to mix an American up, and in some instances is quite annoying. I have prepared the following table, giving some of the more important words and their uses in both countries:

American.	English.
Telegram	Wire
Ticket office	Booking office
Buying a ticket	Booking
Railroad	Railway
Railroad track	Permanent way
Rails	Metals
Depot	Station
Switch	Points
Street car	Tram car
Freight train	Goods train
Cars	Carriages
Conductor	Guard
Engineer	Driver
Fireman	Stoker
Locomotive	Engine
Baggage	Luggage
All aboard	Seats, please
Matches	Lights
Beer	Ale
Switching cars	Drilling cars
Trains meeting	Trains crossing
Freight car	Goods van
Parquet	Pit

There are hundreds of other minor words which at first are confusing. In money we have the sovereign, which is also a quid, and in Yorkshire sometimes called a "thick 'un." A shilling is a bob; a sixpence, a tanner; a ten-shilling gold piece is half a quid and a "thin 'un;" while a crown, or five-shilling piece, is a plunk or "big 'un." The half-crown is known as two-and-six, sometimes two and a tanner. The values of English money are very deluding to Americans. Two shillings for an article doesn't sound expensive, but it is four shillings of American money, and the article looked at from that point may be expensive. — From "England Through Yankee Eyes," in *Frank Leslie's Weekly*, September 5th.

THE "EAGLE" STEEL PENS.

The discussion raised by Mr. Richardson's paper at the recent journalistic convention, has shown very clearly that the best and genuine articles do not bring so much profit to the retail dealers as inferior or counterfeit goods. It may be that it is the reason that the "eagle" pens are not to be obtained in any stationery store in Chicago; at least we have not been able to find one selling them. And yet there is no pen so admirable for general use as E 10 with "Eagle Pencil Co." stamped thereon. These are the pens mostly used in the offices of the Western Union Telegraph Co., as well as many banks and public offices. Every one who tries these pens wants to know where to get them. When stationers say they have not got them, the simplest plan is to report the fact to the Eagle Pencil Co., 73 Franklin street, New York.

DEATH OF ENGINEER STRINGER.

A letter received in this city from William Stringer, a brother of John Stringer, formerly engineer at the Madison water-works station, conveys sad but not unlooked for intelligence of the death of the latter at the home of his sister, Mrs. Reuben E. Neal, in Buchanan, West Virginia. His death occurred on the 20th day of August, after an illness of long duration, for he had been in feeble and declining health for several years. The deceased was a man of good, practical common sense, and proved himself a capable and efficient engineer while on duty in this city. His face used to be a familiar one at the Broadway Hotel, where he boarded, and he made while here many friends who will be sorry to know they shall see his face no more. Peace to his ashes.—*Madison Weekly Courier.*

LITERARY.

The Metal Worker Essays on House Heating, mentioned in our last issue, is a far more valuable work than one might think without reading it. The book, the price of which is $2.50, presents the particular ideas of different men who are actively engaged in the work described. It is not a mere theoretical discussion of principles, but instead contains accounts of how different men would do the same work under like conditions, and also of how the same results may be accomplished by different means. The opportunity of contrasting the several different systems of house heating now in common use which is presented is not the least important feature of the work.

The Liverpool Engineering Society have issued their transactions and report for 1890. In another part of this issue we give an extract from the transactions, being Mr. Brodie's paper on, a water-pressure pumping engine at the Whitehaven Waterworks.

BUSINESS TRANSACTIONS.

Bloomingtou Electric Light Co., Bloomington, Ind., are about to install a 150 h.p. Ball engine, manufactured by the Ball Engine Company, Erie, Pa.

The Hebrew Institute, New York City, are installing an 80 h.p. eugine, furnished by the Ball Engine Co., Eric, Pa., through their representative, E. T. Copeland, 106 Liberty St., New York City.

The Dubois Traction Passenger Railway Co., Dubois, Pa., are installing a 100 h.p. engine, manufactured by the Ball Engine Co., Erie, Pa., and sold them by Dravo & Black, Pittsburg, representatives of the Ball Engine Company.

CHICAGO, MILWAUKEE & ST. PAUL RAILWAY.

Electric Lighted and Steam Heated Vestibuled Trains, with Westinghouse Air Signals, between Chicago, St. Paul and Minneapolis, daily.

Electric Lighted and Steam Heated Vestibuled Trains between Chicago, Council Bluffs and Omaha, daily.

Through Vestibuled Sleeping Cars, daily, between Chicago, Butte, Tacoma, Seattle, and Portland, Ore.

Solid Trains between Chicago and principal points in Northern Wisconsin and the Peninsula of Michigan.

Daily Trains between St. Paul, Minneapolis and Kansas City via the Hedrick Route.

Through Sleeping Cars, daily, between St. Louis, St. Paul and Minneapolis.

The finest Dining Cars in the World.

The best Sleeping Cars. Electric Reading Lamps in Berths.

6,100 miles of road in Illinois, Wisconsin, Northern Michigan, Iowa, Minnesota, Missouri, South Dakota and North Dakota.

Everything First-Class.

First-Class People patronize First-Class Lines.

Ticket Agents everywhere sell Tickets over the Chicago, Milwaukee and St. Paul Railway.

DO YOU SLEEP ENOUGH?

Railroad men are quite apt to deny themselves of sufficient sleep; sometimes for the purpose of working over time and again that they may use the time for their own personal pleasure, a very pernicious practice. The Rev. T. DeWitt Talmage says "there is not one man or woman in ten thousand who can afford to do without seven or eight hours' sleep All those stories written about great men and women who slept only three or four hours a night, make very interesting reading, but I tell you, my readers, no man or woman ever yet kept healthy in body and mind for a number of years with less than seven hours sleep. Americans need more sleep than they are getting. This lack makes them so nervous and the insane asylum so populous. If you can get to bed early, then rise early. If you cannot get to bed till late, then rise late. It may be as Christian for one man to rise at eight as it is for another to rise at five. I counsel my readers to get up when they are rested. But let the rousing bell be rung at least thirty minutes before your public appearance. Physicians say that a sudden jump out of bed gives irregular motion to the pulse. It takes hours to get over a too sudden rising. Give us time, after you call us, to roll over, gaze at the world full in the face and look before we leap."—*Young Men's Journal.*

The Magnolia Anti-Friction Metal Co., of 74 Cortlandt street, New York, have presented us with a handsome fifteen-inch bevel rule, with brass edge, which we highly appreciate. It has the name and addresses of the firm on one side, with a cut of the Magnolia flower and Magnolia metal on the other side.

American Agricultural Machines Wanted.

A German wholesale firm, with English and German references, dealing in agricultural machines, wishes to buy for cash American agricultural machines of latest and approved construction and invites cheapest offers to be forwarded to F. A. 7071, care of Rudolf Mosse, Berlin, S. W. (Germany).

A Mechanical Engineer having had a large experience in a wide variety of engineering work, and possessing a high degree of ability in designing, estimating, supervision and economical management, desires engagement. ddress "A E," Box 589, Ravenswood, Ill.

Map of the United States.

A large, handsome map of the United States, mounted and suitable for office or home use, is issued by the Burlington route. Copies will be mailed to any address on receipt of 12 cents in postage by P. S. Eustis, Gen'l Pass. Agent, C., B. & Q. R. R., Chicago, Ill.

An Opening.—A chief engineer of three years' experience in southwest Virginia, east Tennessee and North Carolina would like to meet one or two bright men with $100.000 each who could complete 15 miles of railroad on which $60,000 cash has been expended for grading this season. The present company are local men who have run out of cash, but the project is as good as ever, and the opportunity now occurs to take advantage of their misfortune. No debts are owing, no bonds have been issued, and about $150,000 of local bonuses are promised. The inducements to take hold are: when built this railroad will inevitably be required by the projected extention of a present large system; it will pay handsomely from the start; and, best of all, large mineral and timber properties can now be secured cheaply, whose value would be greatly increased by the completion of this railroad.

I have no money and no financial connections, but have this opportunity and can give the highest professional references. Address Chief Engineer, P. O. Box 360, Bristol, Tenn.

CONTRACTS OPEN.

Iron Work, Etc. — Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock p. m., on the 28th day of September, 1891, for all the labor and materials required for the iron stairs, iron work, etc., of elevator shaft, for the U. S. Court House, Post Office, etc., building at Denver, Col., in accordance with drawings and specifications, copies of which may be had on application at this office, or the office of the Superintendent at Denver, Col. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposals. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in envelopes, sealed and marked. "Proposals for Iron Stairs, Iron Work, etc., for the U. S. Court House, Post Office, etc., building at Denver, Col.," and addressed to W. J. Edbrooke, Supervising Architect.

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NEW METHOD OF UNLOADING GRAVEL TRAINS.

The accompanying engravings illustrate a new method of unloading gravel or ballast trains which was tried with success last winter on the Delaware & Hudson Canal Co.'s railway. Messrs. Drake & Stratton of New York, have a contract for grading seventeen miles of second track, near Whitehall, N. Y., through a country where the material is of such a character that in cold weather it freezes badly during the haul on cars from the pit to the place where it is to be unloaded. It was found that a mogul engine of the heaviest type could not drag the side unloader or plow through a train of this frozen material, and when two locomotives were used the brakes would not hold the train stationary.

To have abandoned the work until the spring would have caused considerable loss and incovenience to the contractors and company, and the contractors therefore decided to try the plan of fitting to the first car of the train a stationary winding or hauling engine for dragging the plow.

The engine does the work well, and is very satisfactory and economical.

It has been used to unload trains of sixteen flat cars.

The contractors have recently purchased another hoisting engine of the same kind, and will place it on a car with a boiler, so as to be independent of the locomotive.

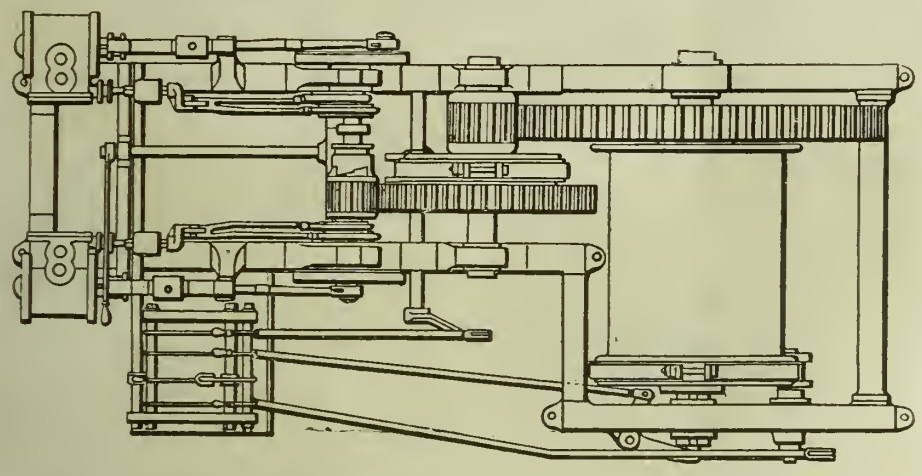
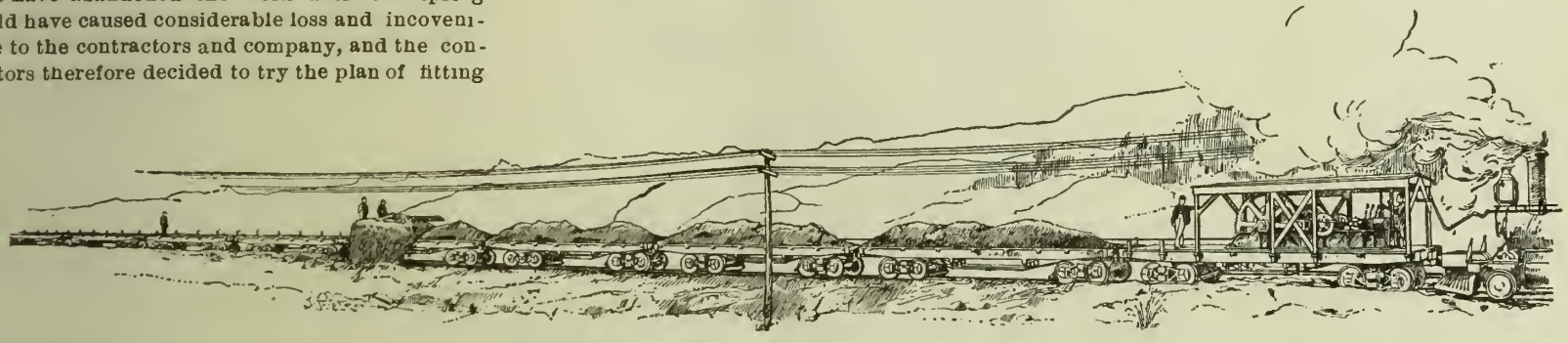


FIG. 1.—HAULING ENGINE FOR PLOW USED FOR UNLOADING GRAVEL TRAINS.



NEW METHOD OF UNLOADING GRAVEL TRAINS.

The plant was furnished by the Lidgerwood Manufacturing Company of New York, and is shown in figures 1 and 2. It consisted of an improved Lidgerwood heavy hoisting engine with one drum, guaranteed to lift twenty-five tons on a single line at a speed of 100 feet per minute. This engine was mounted on a flat car, thirty-four feet long, of 60,000 lbs. capacity over which a temporary roof was erected, and was supplied with steam from the locomotive through the flexible piping shown in the general view of the construction train, Fig. 3.

The plan proved very successful, and resulted in a considerable saving of time as compared with the ordinary plan of attaching the plow to the locomotive by a cable and hauling it along by running the engine ahead. Mr. A. J. Swift, chief engineer of the road, in a letter to the Lidgerwood Manufacturing Company, dated January 24th, 1891, stated as follows:

"From the very first trial the plan proved very successful, and the work is now progressing at a satisfactory rate, the unloader breaking up and depositing the frozen material in a way that is surprising. It seems to me so desirable and satisfactory a plan of operation that I feel sure it would recommend itself to any contractor or engineer interested in handling bad or frozen material. It is particularly valuable to the railway company interested in such work, because the action is certain and quick, and enables a construction train to finish its work on the main track and resume to the gravel pit in a fraction of the time occupied by abortive attempts to do the same work by locomotive traction."

OLD AND MODERN WAYS OF STEAM HEATING.

An article is going the rounds to the effect that the use of steam for heating purposes far antedates the time when James Watt conceived the utilization of it for power. As long ago as the days when Pompeii flourished in its original splendor, steam was used for the purpose of heating buildings, for subsequent excavations have brought to light indisputable evidence of its use. In those days the "true and reliable" way to utilize this convenient mode of heating was to build in the partitions of the houses hollow passage ways, into which the steam was supplied, when by radiation solely the desired heat was transmitted to the apartments to be warmed. With the introduction of pipe it was found more convenient and economical to convey the steam to hollow receptacles, which were set in the different rooms to be heated. The joints in the pipe were made tight by the use of yarn packing, and it is a matter of great surprise to the enlightened American that even to-day this mode of connecting pipes is largely used in England, says *Specialties*. The Englishman takes slowly to the idea of threading pipes and connecting them by the use of a little red lead. Following along the line of advancement we find that wrought iron pipes are now largely supplanted by neat and ornamental radiators. It is found that greater possibilities of ornamental designs are to be had by the use of cast iron, and again cast iron, being homogeneous, gives off heat with greater freedom, representing a superiority over wrought iron as a radiator of from 18 to 25 per cent. Wrought iron conducts heat; cast iron radiates it; wrought iron is a fibrous structure, cast iron a homogeneous one; and so where heat is to be imparted and not stored, cast iron is more desirable to use.

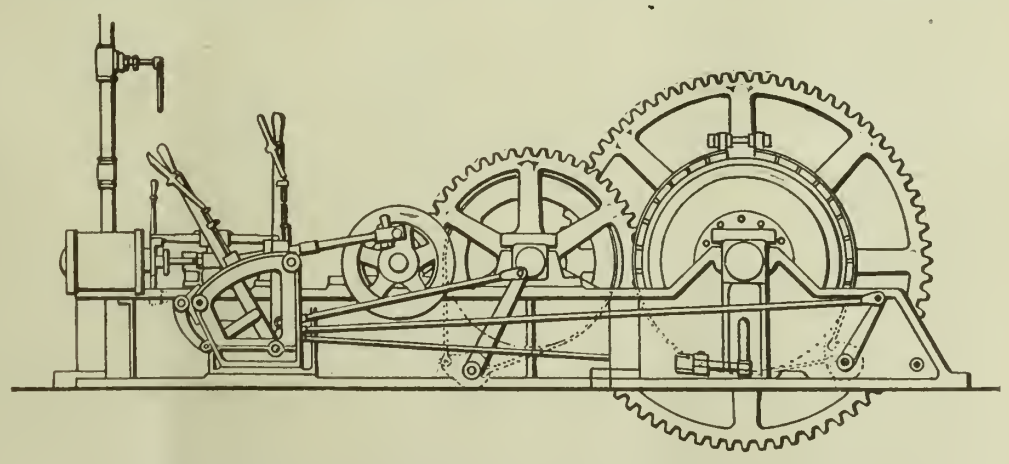


FIG. 2.—HAULING ENGINE FOR PLOW USED FOR GRAVEL TRAINS.

ELECTRICAL TRANSMISSION OF POWER.

The problem of transmitting electrical energy over long distances seems to be gradually being solved, says *Invention* (Aug. 29). Hitherto experience has demonstrated that it was possible to convey or rather cause to be conveyed, power over distances up to about 20 miles, but beyond that distance very little has been done by electricity. A scheme on a gigantic scale was, however, brought forward some time ago for the electrical transmission of 300-horse power from Lauffen to Frankfort in connection with the Electrical Exhibition now being held in the latter town.

This project seems to have been successful. At noon on Tuesday the electric lamps in the Exhibition were lighted for the first time by the current transmitted from the generating center at the Lauffen Falls of the Neckar, over 100 miles distant from Frankfort. On Monday the various authorities at Wurtemberg, Baden, Hesse, and Prussia, through whose territory the overhead conductors pass, formally took over the undertaking, and subsequently made it over to the General Electricity Company, of Berlin, and to the Oerlikon Engineering Works, of Switzerland, the constructors of the plant and electrical appliances.

At eight o'clock in the evening the electric current was transmitted from Lauffen along the conductors, and it was found that the precautionary measures along the line to insure the safe transmission of the electric current were perfect. The representatives of the Wurtemberg authorities had assembled at Lauffen itself, the generating centre, while the representatives of the Baden and Hesse authorities, together with Herr von Miller, representing the Exhibition, Herr Ebert, representing the Imperial Postal Department, Herr Strecker, the

head engineer of the Telegraph Department, Herr von Dobrowolski, representing the Electricity Company, and Professor Weber, of the Testing Committee, met at Eberbach, on the confines of Baden and Hesse, where they made some experiments.

If the success of this installation continues, it will open up a great future for the electrical transmission of power, and for the use of electric power conveyed over long distances for industrial purposes. The main considerations are the initial cost of the installation and the results obtained at the receiving end of the line.

UNIVERSAL MILLING MACHINE.

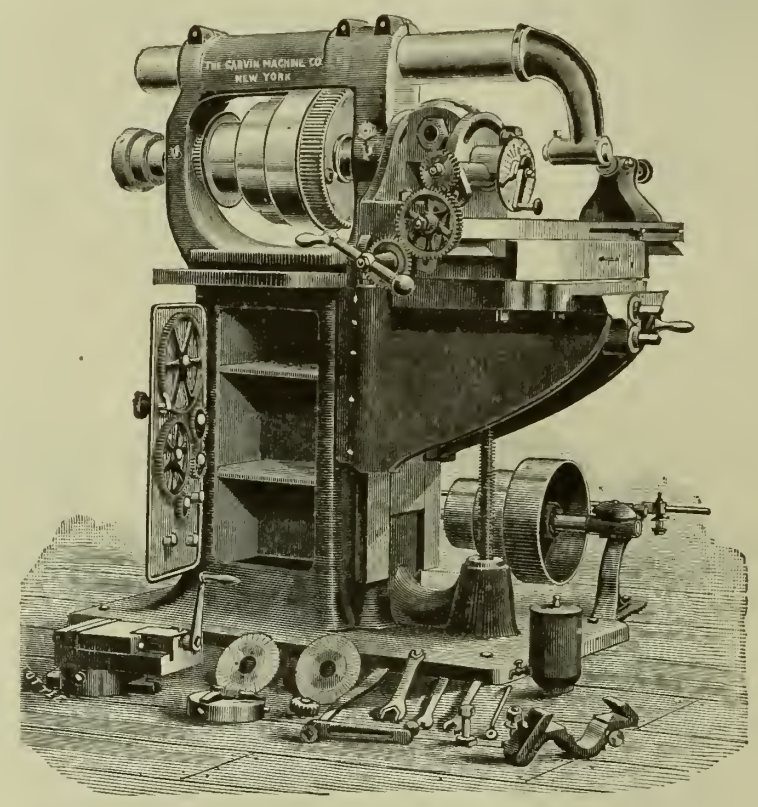
The accompanying illustration is of a milling machine, which is representative of a new line of similar machines which are just being brought out by The Garvin Machine Co., of New York City.

The principal new features of this machine are a telescopic arm with bearings for same, tied together with a tubular form of casting which gives additional rigidity to the arm; a point that heretofore has been considerably overlooked by milling machine builders.

The machine shown is designated by the makers the "No. 3," and is intended for such work as that done by steam engine and locomotive builders, where heavy cuts of considerable length are to be taken.

It will be noticed that the machine is back-geared, giving eight rates of speed, while by the introduction of spur gears between the various feed cones, a much greater range of feeds is obtainable than is usually the case; there being 24 rates of speed for each spindle speed. This makes it possible to use the automatic feed for all sizes of cutters, including the smallest stem cutters.

The spindle bearings are of a newly designed form, adapted to take up wear, and the outer bearing for the arbor is hardened and ground cylindrical in form, so that there is sufficient bearing surface and opportunity for expansion of the arbor by heating during the cut, without straining the machine, or bringing undue pressure upon any part of it. The overhanging arm is held within a sleeve which joins the two standards. It has a bearing in this sleeve at each end, and is clamped in position by three bolts.



The machine is universal, and is capable of doing a large range of indexing and spiral cutting. The feed is tripped automatically at any point, with the table moving in either direction. Shoulders of all actuating screws are provided with means for taking up the wear.

Graduations show the movement of the table in thousandths of an inch, and on the crank wrenches, where it is in plain sight of the operator when adjusting the machine, is stamped a table of decimal equivalents giving the number of graduations (thousandths) necessary to be moved to obtain the ordinary parts of an inch.

The overhanging arm is 5 inches diameter; front spindle bearing 3x5½ inches. Work 13 inches diameter and 28 inches long can be placed between the centers, the table being 48 inches long and 7 inches wide. Table can be raised up to the spindle center, or dropped 24½ inches below it; its in and out movement being 10¾ inches. The manufacturers build, of similar design, a No. 1 machine weighing 1,400 lbs.; No. 2 machine weighing 2,500 lbs. A No. 3 machine weighing 4,000 lbs.; and a No. 4 machine weighing 4,300 lbs.

CORNISH BOILERS.

In the course of the tests of steam boilers undertaken by Mr. Bryan Donkin, Jr., and Professor A. B. W. Kennedy, an experiment was made upon three Cornish boilers in regular use by the East London Waterworks Company, which may be taken as exemplifying the performance of this class of steam generators when set and worked in good style, without an economizer. The experiment lasted from 8:50 a. m. to 6:50 p. m., two of the boilers being fairly clean and the other rather dirty. The feed-water was taken from the hot well of the engine, and the furnace gases were sampled periodically at a point in the main flue where the products of combustion of all three furnaces united just before passing the main damper. The fuel used was the standard coal selected by Mr. Donkin for all the experiments. It is practically smokeless. In the present case the firing was done by the ordinary stokers. Each boiler was 30 ft. long and 5 ft. 9 in. diameter, with a single flue 3 ft. 6 in. in diameter, crossed by three Galloway tubes, the total heating surface of the boiler being 700 square feet. Rather thick fires were kept.

The waste gases entered the chimney at a temperature of 485 degs. F. The balance sheet of the boilers showed that the heat accounted for in the water was 78 3 per cent, 14 per cent going away in the furnace gases, and 4.4 per cent being lost by radiation. The equivalent evaporation per pound of coal as burnt from and at 212 deg. F. was after the rate of 11.4 lb. of water. The absolute steam pressure maintained was 51.7 lb.—*Invention.*

THE PRACTICAL APPLICATION OF THE STEAM ENGINE INDICATOR.

BY E. H. BODEN.*

The object of this article is to describe the methods generally employed for taking indicator diagrams from steam engines.

In order to get the same pressure of steam on the indicator piston as that on the engine piston it is necessary that some means should be provided for the communication of the steam.

For this purpose the engine builders generally fix a thin pipe communicating with the front and back ends of the engine cylinder, the mouth of this pipe being just clear of the piston rings when the piston is at dead center. These holes are tapped out with a gas tap and the indicator pipe screwed in; it is generally attached to the cylinder on the opposite side to that of the valve chest. It is of course in no way necessary that it should be on this side, but is most convenient in this position under ordinary conditions for a horizontal engine. This pipe should be not less than ½in. in diameter swelled to ⅝in. at the bends.

The cock in the center of the pipe is for the indicator, the plug being arranged "two way," in order to allow of either end of the cylinder being put in connection with the indicator. This arrangement, from a mechanical point of view, is very convenient; it is not in some cases advisable, however—viz., in the case of long cylinders or where the pipes are exposed to the cooling action of a current of air. In these and similar cases better results will be obtained by attaching the indicator direct to each end of the cylinder by a short pipe. The previous arrangement has the advantage of being able to take diagrams from each end of the cylinder without removing the indicator. In some cases the pet cocks on the cylinder covers are made to receive the indicator.

The Richards indicator as constructed by Messrs. Elliott Brothers, has earned a very good reputation for itself. The following is a list of the springs used with the instrument and fixed above the indicator piston.

1/8in. by scale represents 1lb. pressure				
	per sq. in.	indicates	from	
1/12in.	"	"	—15 to +	10 lb.
1/16in.	"	"	—15 to +	22·5 lb.
1/20in.	"	"	—15 to +	35 lb.
1/24in.	"	"	—15 to +	47·5 lb.
1/30in.	"	"	—15 to +	60 lb.
1/32in.	"	"	—15 to +	78·75 lb.
1/40in.	"	Atmosphere	to +	100 lb.
1/48in.	"	"	to +	125 lb.
/60in.	"	"	to +	150 lb.
1/64in.	"	"	to +	175 lb.
/72in.	"	"	to +	200 lb.
			to +	225 lb.

When springs for higher pressures than these given are required, the indicator makers supply them.

It will be observed from the foregoing that the springs compressed from 1/32in. to 1/72in. per lb. do not indicate any pressure below that of the atmosphere, consequently any of these latter springs would not indicate beneath the atmospheric line, and should not therefore be used for condensing engines. The reasons for constructing the high-pressure springs in this manner are—1st, engines that work at pressures of 80lb. and upwards generally exhaust above 15lb. pressure; 2nd, at pressures ranging from 80 or 90 to 180lb. the indications of the vacuum side would be much too small to be convenient, and would in many cases fail to indicate the actual state of the engine, consequently for low pressure ⅛ in. spring may be used with good results; this spring is often used when taking "cards" from low-pressure cylinders.

Taking the boiler pressure at 50lb. for a condensing engine, then it may be presumed that under good conditions the engine piston would receive a pressure of 45lb. per sq. in. It may here be remarked that it is a very rare occurrence for the full boiler pressure to be brought on the piston as losses from several causes are practically unavoidable, among which are loss of pressure through friction in the pipes, loss from radiation of heat from the steam or sharp bends in the pipes, all tending to reduce the pressure. In this case with 45lb. and condensing, 1/20in. or 1/24in. spring may be used—viz.,—15 to + 47 or —15 to + 60; these springs will both show the pressure exhausting. The springs are fixed in the indicator cylinder by removing the cover and screwing the spring on to the thread at the top of the piston.

In practice it has been found necessary to limit the travel of the indicator piston to about ¾in., while the diagram is wanted considerably larger; this is obtained by applying parallel motion. The object gained by limiting the range of the piston is that the combined velocity and momentum are reduced. This is of considerable importance, as otherwise the stored-up energy in the moving parts overcome the resistance of the spring.

It is evident that the drum of the indicator cannot be connected direct to the engine crosshead, as the travel of the latter may reach 7 ft., while the arc described by the drum of the indicator is only 2in. or 3in. The general method of reducing the travel of the cross-head to suit the indicator is to secure a rod of metal or wood to the ceiling of the engine-house, the other end having a slot which works on a pin attached to the cross-head, or the rod may be in two pieces, one telescoping into the other. At each reciprocation of the cross-head this rod should hang plumb when the piston is in the middle of its stroke. A point is taken in this rod with a motion corresponding to that of the indicator drum. The connecting cord between the indicator and rod should be kept at right angles as far as possible; that is, supposing the cord to be parallel to the piston rod for the length of the cylinder, it should

* In the *Mechanical World*, in whose Prize Competition this article was awarded half a guinea.

not then be allowed to make an obtuse angle with the latter, but should be kept at right angles.

In fixing the paper the outer cylinder should be taken off and one edge of the paper secured by one of the springs; it should then be bent round the cylinder and the other end secured between the two springs. The "card" should be long enough to allow of its being out about ½in. at each end; it should then be pressed down to the bottom and the cylinder replaced.

Before attaching the indicator the cock on the cylinder steam pipe should be first opened for a few seconds to allow any grease or water to be blown out. The cock and union screw at the bottom of the indicator should be unscrewed and screwed on to the cock on the steampipe; this method allows of the indicator being fixed without turning the whole instrument round. The hook on the cord at the end of the indicator drum should be held up against the chain on the motion rod, and after fixing on the link to give the requisite motion, it should be fixed as the crosshead is on the "in" or return stroke.

The under side of the indicator piston should next be put in connection with the atmosphere by placing the cock at the bottom of the indicator, which is a three way—made thus ⊢ —, in connection with the air-hole on the outside case; the parallel motion should then be brought to bear on the indicator "card." The straight horizontal line drawn as the drum revolves is the atmospheric line; the position of the line of perfect vacuum depends on the scale of the spring being used.

The cock should be again turned so that the underside of the indicator piston is put in communication with the engine cylinder. The pencil should be allowed to trace the diagram a few times, when the cock may be closed to steam and the opposite end put in connection with the indicator.

It is scarcely necessary to say that both the indicator and springs, after having been used, should be well cleaned and oiled before being put away.

THE FIRST LANDING PLACE OF COLUMBUS.

The Chicago *Herald* publishes a long article giving the results of the expedition which it sent out a month ago to find and mark with a monument the spot at which Christopher Columbus first landed on the shores of the new world, October 12, 1492. The expedition met with success. At Nassau, the capital of the Bahamas, Governor Shea gave the expedition a letter of authority, calling upon all local magistrates to give every assistance in their power. The steamer Nassau, the largest steamer in the Bahamas, was chartered for the cruise, and it left Nassau June 9th.

Five islands have been suggested as the scene of the discovery,—Cat Island, which for many years was marked San Salvador on the maps; Watling's, Samana, Mariguana, and Turk's Island. All but two

From the first moment, evidence that Watling's Island was the true San Salvador appeared on every hand. None of the previous writers or investigators in the field had taken the pains to do that which the *Herald* expedition did—visit the spot in person, and apply the historic evidence, that of Columbus himself, to the physical features of the island. In this way the Chicago explorers were able to find new and convincing proof of the identity of Watling's Island with the San Salvador of the great discoverer. In fact, the evidence is so strong as to be indisputable. It is far beyond the range of the probable that at any other point there exist, one beside the other, such a harbor and such a headland, answering in every particular, both as to themselves and as to their relative positions in an island, which also meet every requirement of Columbus's description of his San Salvador.

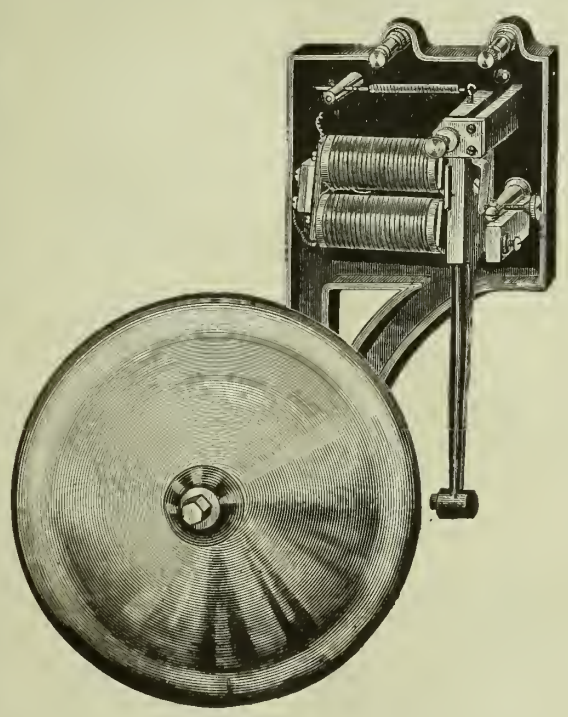
These and hundreds of other considerations induced the *Herald's* expedition to erect its monument on the northeastern shore of Watling's Island, on a headland overlooking the little shady beach bay in which Columbus landed. More than a score of workmen were engaged building the monument. Fortunately, an ample supply of coral limestone of beautiful colors and picturesque shapes was found of these (Watling's and Samana) have been virtually discarded by modern geographers and historians. The journal or log-book of Columbus is the only historic evidence there is of the landing place on the headland. The monument rises sixteen feet from its foundations. Six feet from the level of the ground in a pretty grotto, built for the purpose, is a marble globe, nearly two feet in diameter, with an outline of the continents chipped upon the surface. A silver star marks the site of Chicago, and another star marks the true San Salvador of Columbus,—Watling's Island. Below the globe is a marble tablet on which is carved: "On this spot Christopher Columbus first set foot upon the soil of the New World. Erected by the Chicago *Herald*, June 15, 1891."

The monument was dedicated at four o'clock in the afternoon of June 15th, with short but appropriate ceremonies. An incident of the building of the monument was the placing within the foundations of portraits of the great editors of the United States, and copies of a number of leading American newspapers, making the structure, in a sense, a newspaper offering to the memory of the great discoverer.—*N. Y. Observer.*

DOUBLE ARMATURE ELECTRIC BELL.

The illustration in this column gives a view of a double armature heavy stroke electric bell manufactured by J. Elliott Shaw & Co., manufacturers of, and dealers in electrical supplies, 532 Arch street, Philadelphia, Pa.

There is a great improvement in the electric bell here shown, which consists in the construction of



the armature in two sections, a light one held loosely in the recessed face of a heavier section. The lighter section, being in the field of attraction and more sensitive than the heavier one, is drawn to a point very near the magnet-poles where the attraction is sufficiently great to cause the lighter section to draw the heavier one into contact with the magnets with great force, thereby allowing a much greater movement of the striker than where a solid armature is employed, which enables a tone to be produced that has heretofore only been obtained by some mechanical winding appliance which needs constant attention.

This bell needs no winding and will work with less battery current than others carrying the same size gong, it is said, and it will give a much louder tone. The magnets are wound to a resistance of 7½ ohms, but others can be substituted for those of high resistance for long lines or heavy currents.

The bell gives equally satisfactory results either as a vibrator or stroke, and is especially recommended for fire alarm, railroads, steamships, etc.

THE METALLIC-IRON PURIFIER.

At the International Congress of Hygeine and Demography, held in London the middle of August, Dr. W. Anderson read a paper on the Revolving Purifier for Treatment of Potable Waters by Means of Metallic Iron. Following is a summary thereof as it appears in *Invention*:—

Since the revolving purifier for the treatment of potable water is no novelty, but has been at work on a large scale at various places for some six or seven years, it is not proposed to enter into any detailed description of the apparatus or of its mode of working. For the information, however, of those who are not acquainted with the purifier, a short account is necessary. The apparatus consists of a cylinder, supported horizontally on two hollow trunnions, of which one serves for the entrance and the other for the exit of the water. The cylinder contains a certain quantity of metallic iron, in the form either of cast-iron borings, or, preferably, of scrap iron, such as punchings from boiler plates. The cylinder is kept in continuous but slow rotation by any suitable means, the iron being continually lifted up and showered down through the passing water by a series of shelves or scoops fixed inside the shell of the cylinder. By this means the water, as it flows through, is brought thoroughly into contact with the charge of iron, which, in addition, by its constant motion and rubbing against itself and the sides of the cylinder, is kept always clean and active. Simple contrivances for preventing the iron from being carried out of the cylinder or piled up at the outlet end, and for distributing the current of water over the whole area of the cylinder are also furnished, but need not be described. The water as it leaves the cylinder appears to have undergone only one change of any importance, viz., a quantity of iron, ranging from one-tenth to one-fifth of a grain to the gallon, has been taken up, and to get rid of this the water has to be aerated either by blowing in air, or by merely allowing it to flow along a shallow open trough; in both cases repose in a settling reservoir is necessary. After a few hours—from two to six in most cases, much less in some—the greater part of the iron will have subsided to the bottom of the settling tank, usually as loose flakes of iron peroxide associated with organic matter and other impurities, and the water is then ready for filtration. In most cases a rapid passage through a shallow layer of sand is all that is required to separate the iron, which remains as a fine layer on the surface of the sand, while the water issues from the filter free from iron, greatly ameliorated as regards organic matter, and practically deprived of microbes. The revolving purifier was invented by Dr. Anderson in 1884-5, to meet the difficulties which arose in the working of the "spongy-iron" filters at the Antwerp waterworks. These filters, which consisted of a mixture of "spongy-iron" and gravel, choked up gradually and became almost inactive, after working for three years very satisfactorily as regards the purification of the water. They were replaced by the revolving purifiers, which have been in operation there ever since with most satisfactory results. The results obtained on the practical scale at Boulogne-sur-Seine during the past year were given.

A purifier with 6in. inlet pipe, capable of dealing with 200,000 gallons daily, was erected last summer at the pumping station of the Cie Generale des Eaux, at Boulogne-sur-Seine, and was at work there during the autumn, most exhaustive trials and analyses being made. These referred mainly to bacteria and to organic matter as estimated by permangante of potash; satisfactory results were obtained in both respects, especially as regards bacteria, which were reduced to less than 50 per cubic centimetre. In consequence of these trials, larger apparatus is now under construction for permanently dealing with the whole of the supply at these waterworks. It has often been asserted by opponents of this system that the quantity of free oxygen in the water is diminished by treatment with iron, and that, in consequence, the purified water has a vapid flat taste. Experience on a large scale, however, has shown that the water is in all cases thoroughly aerated after leaving the purifier, and numerous analyses prove that the quantity of oxygen is not lessened. To show that the process is really superior to simple sand filtration, and to answer those who may assert that it cannot be proved that sand filtration will not do all that the purifiers can do, results were quoted which have been obtained with a 3ft. machine at Agra; with three 14in. machines at Montevedio, in South America, and with a 1in. machine at Hampton Court. In all these cases, comparisons have been made between simple sand filtration and sand filtration aided by the revolving purifiers, and in each case the superiority of the purifier is well marked, especially as regards the chemical analysis of the water. The results quoted in the paper have not been obtained by small laboratory experiments, but from machines, some of a very large size, working continually under practical conditions.

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ARTICLES:

PRACTICAL AND THEORETICAL ENGINEERS

"Be a whole man" was the advice contained in Mr. Bullock's premium article published in the AMERICAN ENGINEER a few months ago. The same theme is dilated upon in our British contemporary *Invention*, as follows:

Some engineers find a great difficulty in learning from books such things as are applicable in their business. The chief camplaint from many engineers in regard to books is that they cannot understand the application of the information they contain, and in many cases there is good reason for this, but it is principally owing to their defective training when children. Many good engineers who have learned what they know by daily practice in the engine room, who have shown their qualifications by years of constant work at the business, and who are capable not only of taking care of the plant as it stands, but of erecting a plant and making it work successfully, are completely floored when they are called on for a rule that applies to any branch of the business, and yet at the same time in their own minds they understand the principles, and express themselves to the effect that if they knew the rules and could figure those things out, it would help them greatly in their practice.

A rule which will apply in a particular branch of work does not, as a general thing, contain anything that shows directly the application of the rule, and in fact, a rule is a simple statement of general principles that will apply almost indefinitely, and it is for this reason, perhaps, that they are confusing to those who have not been especially drilled in the comprehension of such methods of showing the results of special investigation and the methods of applying the principles, but a similar difficulty is experienced by those who have learned the rules and formulas from the book and have not been taught the general application, for, while the practically educated man is at sea when rules and formulas are in question, so in a similar number of cases will the graduate meet with difficulties in the efforts to put his rules into practice. Formulas are even more confusing to those who have not been taught their use and application than are rules, but when once understood they are more serviceable and much more easily made use of.

Among the many engineers of my acquaintance, writes C. Davidson, I frequently find those who can best understand through the medium of the eye; that is, what they see worked out and put into practice, that they can thoroughly understand, for the eye has the faculty of following and the mind of noting every movement, every change, and every arrangement throughout the whole operation in a manner somewhat similar to that in which the skilled phonographer will follow the words of a rapid speaker, and these engineers who have once seen an operation performed can at any time thereafter go through the same operation themselves, even though weeks or months may have elapsed between the time when their attention was called to it and the time when they are called to do the same thing themselves. For reasons similar to those mentioned above, all men cannot have the same use of their faculties, neither can the same faculty be the strongest in all, but each man according to his aptitudes may become an expert in some branch from the use of faculties entirely different from those employed by others who are also expert in the same branch, but in spite of this, the purely practical man and the purely theoretical man can never be brought to agree on the same subject, although both may attain the same end by different means, simply because each looks at it from a different standpoint.

"TOO MANY COLLISIONS."

Strange heading this for an article on the numerous railway collisions which have taken place during the past two or three months. This caption suggests that there ought to be some collisions. Yet this is the heading used by an esteemed contemporary over an article which opens up with this paragraph:

"The record of the past few weeks in the number of trains that have run into each other—rear end collisions—is almost without parallel in the history of railroading. Not only is the number of such accidents large, but the fatalities resulting from them is something frightful."

The paragraph which follows this is a curiosity among the most curious railroad literature. It opens with the presumption that "these accidents" are unavoidable, and ends with the assertion that, because they occur, "there must be fault somewhere." Here is the whole piece:

"It is beyond human control not to have more or less of these and other accidents. Iron and steel will at times fail us in spite of the closest attention, and human beings are not infallible at all times. But such a record as that of the past few weeks is a reflection on railroading, and too flagrant an exhibition of the frailties of man, and of iron and steel. Much wit and sarcasm have been expended at the expense of the rear brakeman, who is supposed to instantly go back when his train stops, and flag any possible approaching train of the danger ahead, and there has been much public censure of freight trains stopping just far enough behind a sharp curve for an approaching express train not to see them. But in spite of all these, the number of accidents does not seem to be lessened. Wit, sarcasm and censure have done their part, but still accidents occur, so there must be fault somewhere."

Our contemporary shows more wisdom as the article proceeds, and exhorts those having control of such things to reach on after greater perfection in the operation of railways. They indulge in one other contradiction, saying:

"We do not intimate that railroads jeopardize human life unnecessarily, but they do too often stretch a point in their own favor when it comes to providing safety appliances and paying out money for them. And not infrequently they pay dearly in the end for their supposed economy."

Then they earnestly advocate the adoption of a more perfect system of signaling, and say—"Railroads scrimp too closely in the matter of supplying themselves with signals, As a whole, they do not avail themselves of the advancement signaling makes, in spite of the fact that a large proportion of the accidents are caused directly or indirectly by inefficient, or the absence of, signals. A good signal outfit costs money, it is true, but accidents cost money, and much that money cannot replace, when so many deaths result from the accidents, as has recently been the case. So that the question resolves itself into, Can we afford to be without good and efficient signals? rather than, Can we afford to buy good signaling apparatus? The days of 'trusting to luck' are past in railroading, although now and then evidences of its presence crop out, in such frequent cases, for instance, as sending a brakeman back, or expecting him to go back, when a train is unexpectedly forced to stop between stations. There is no reason in many such cases why there should not be mechanical appliances of some sort on most roads to supplement the signal of the brakeman. Safety and economy demand them."

CHIEF ROBINSON, MACHINERY DEPARTMENT, WORLD'S COLUMBIAN EXPOSITION.

In a recent issue we mentioned that Director General Geo. R. Davis had nominated Lieut. Robinson to be chief of the Department of Machinery of the World's Fair. His appointment has since been completed.

Lewis Wood Robinson is a chief engineer in the U. S. Navy and is well acquainted with business men throughout this country, while he has had valuable exposition experience. He was born near Haddonfield, N. J., March 7, 1849, but was soon removed to Philadelphia, where he has resided "all his life, except when on duty." A dispatch from the City of Brotherly Love (Sep. 9) says:

The profession of civil engineering pleased his fancy and September, 1861, found him pursuing that vocation. As a Third Assistant Engineer he entered the navy, was assigned to the Kennebec, and sent to the West Gulf Blockading Squadron. He participated in the capture of Fort Jackson and St. Philip, the attack on Vicksburg, the blockade of Mobile, and the stirring events of that section. In less than two years he was made Second Assistant Engineer of the Kennebec, which position he held until June, 1865. In 1875 Mr. Robinson obtained leave of absence and occupied the position of General Superintendent of the Bureau of Machinery of the Centennial Exhibition, which position he held until Jan. 1, 1877, when he was ordered to the United States Naval Academy at Annapolis as senior instructor in the Department of Steam Engineering. In April, 1883, he was raised to the position of Chief Engineer, with rank of Lieutenant-Commander, and was ordered to the League Island navy yard in connection with the work of fitting out the U. S. S. Ossipee. He afterwards made a cruise to the Atlantic station on the Ossipee, returning in 1877. He was then ordered as a member of the Naval Examining Board at Philadelphia, which position he fills at present.

AN ALL-ROUND MAN WANTED.

What will our amateur and practical electricians and others, think of the following advertisement, which appears in the *South Wales Daily News* of Aug. 24?

"Electricity—Wanted immediately, thoroughly experienced person, with practical knowledge of electric lighting, to take charge of engine, boiler, and dynamo, do own repairs, and fill spare time in grocery store-room; permanency for good man.—Apply, enclosing copies of testimonials, stating salary and experience, Co-operative, Abertillery."

CANADA'S WELCOME TO UNCLE SAM.

Electricity brings Canada nearer to the United States than ever. In reference to the conference of electricians, at Montreal the past week, the *Canadian Electrical News* says:

WELCOME.

It has become our pleasant duty in this issue to offer words of welcome to our brethren the members of the National Electric Light Association of the United States. As Canadians, we feel honored by the selection of one of our principal cities as the meeting place of such an illustrious assemblage, and we trust that the visit will not be without pleasure and ultimate profit to the dispensers of illumination, their confreres the fabricators of mechanism, and above all, to the men of mighty brain who have been most instrumental in developing the revolutionary force of electricity. Welcome one and all to the land of the beaver and the maple leaf! May your lights be never dimmed or your shadows grow less. We welcome you, from whatever part of the great Republic you come—from the sunny south or the wild and wooly west, from the land of the wooden nutmeg and the basswood ham, from New York or the sylvan state of William Penn. We are prepared to do homage to the smartest nation on the face of the earth. The effete monarchies of the old world are nowhere. In the early development of the science, the European discoverer was content to rub his coat sleeve with a chunk of sealing wax, but your Franklin had the nerve to gather his electricity from the raging thunder storm. It served Galvani's turn to tickle frogs' legs with mild electric currents, but you are satisfied with nothing less than humanity itself to practice alternating currents on. From touching up the stern of a bull-frog to electric execution is a fairly long stride, but you have made it. All hail!

Since Franklin's brilliant but cheeky experiment with a flash of lightning, the principles of the science have been discovered by men of other lands; but for the development and practical commercial applications of such discoveries, your country stands pre-eminent. Paccinotti, for instance, may have thought about a certain form of ring, but Brush made electric lights with it, and what is more, he sold them to good advantage, too. His success financially was well deserved, though it does not always fall to the lot of inventors to be rewarded in this world. Wilde and Ladd and Sawyer died poor as rats, but Thomson and Houston and Edison have succeeded in piling up on their gravestones a couple of syndicates that will presently be reaching for heaven after using up all the earth available.

Truly, yours is a great country, and as its representatives and the exploiters of a great and growing industry, we are proud to have you in our midst, and extend to you the right hand and hearty grasp of good fellowship. The star-spangled banner shall be entwined with our own Union Jack, and may the sentiment of every loyal American and Canadian be: "Long may they wave!"

IMPORTANT WATER WORKS MACHINERY.

A water-works pump ("formally opened" July 8,) at Audley, Staffordshire, England, with a capacity of 260,000 gallons per day, and that against a most heavy pressure, is described, with its environments in *Electrical Plant*:—

The parish which contains a population of about 16,000, consists of a number of villages scattered over the mining district of North Straffordshire. It was found necessary to obtain the water from the sandstone formation below the level of the deepest mines in the immediate neighborhood in order to secure a constant and pure supply. In consequence of the scarcity of water, the Local Board some years ago, adopted a partial scheme by which one part of the district was supplied; this has now been extended, and the new system just completed provides for a daily supply of 260,000 gallons.

The pumping machinery is capable of delivering 20,000 gallons per hour into the high-service reservoir, through three miles of leading mains from a depth of 530 feet.

The pump well is 100 feet deep, and is lined through with cast-iron tubing in bracketed segmental rings, each 5 feet deep and averaging ⅝ in. thick.

The tubing is bellied out to a diameter of 7 feet at the top, where provision is made for receiving the guide by cast-iron girders and slideboxes. There is a borehole 100 feet deep at the bottom of the well.

The pump, which is of peculiar construction, is driven direct from the triplethrow crank shaft by three long wrought-iron pump rods attached to the bucket and crosshead.

It consists of two buckets working in one gun-metal lined barrel; the lower bucket being actuated by the center pump rod of wrought-iron, which passes through the upper bucket, and through a stem sleeve. This sleeve is screwed into the upper bucket and also to the underside of the cross-head to which the two outer wrought-iron pump rods are attached; thus enabling the upper bucket to work in a contrary direction to the lower one, and giving a continuous flow of water through the working barrel.

The valves of the buckets are so constructed as to partly rotate at each lift. The water delivered from the pump is forced through one of Masterman's patent diaphragm condensers, fixed below the floor, fitted with the "Credenda" steel tubes, and having a cooling surface of 390 square feet. Immediately outside the engine house is a cast-iron air vessel, also a retaining valve and a relief valve, the latter weighted to release at a pressure of 300lbs. per square inch. A "bye-pass" is arranged from the pump to the air vessel, by which the water can be carried past the condenser if it is desired to work the engine at high pressure.

The engines are of the compound coupled type, fitted with the above described condenser, and are of 110 indicated horse-power, when working at their normal speed of 75 revolutions with a boiler pressure of 70lbs. The high pressure cylinder is 12 inches bore, and the low pressure 22 inches, each having a stroke of two feet. They are steam-jacketted, lagged with mahogany and bound with brass bands. An "Acme" governor fixed on the steam chest regulates the supply. Slipper guides are attached to the ends of the piston rods, and the connecting rod and shaft bearings are of gun-metal of ample size. The eccentric rods are constructed of steel tubes, and the shaft is of best hammered iron; while the three-throw crank shaft is driven by a mortise wheel which takes motion from a pinion geared in the ratio of three to one.

Steam is generated in two Cornish boilers, each six feet in diameter by 24 feet long, made of best Staffordshire plates and tested by hydraulic pressure to 120lbs. per square inch; these are fed by a common donkey pump placed in the engine house and drawing water from a wrought-iron hot-well outside the house.

In addition to this there are auxiliary pipes attached to the boiler feed to prevent any possible interruption to the supply of feed water. An arrangement in the roof of the engine house facilitates the drawing out of the pump rods when the buckets require changing, and a traveling crane is fixed over the engine in order that any part of the machinery may be easily moved.

OIL AS FUEL FOR STEAMSHIPS.

A great saving in weight and cost of stoking is to be effected by using oil as fuel on steamships, instead of coal, according the "remarkable results" discovered by a New York paper, which says:

It is a great advance toward the employment of petroleum instead of coal for generating steam in the boilers of marine engines to find that the question is now nearly reduced to one of cost. When it comes absolutely to that point its use for some branches of navigation will be assured. There will be petroleum regions which can employ liquid fuel for their locomotive and ship engines, while many naval vessels will not allow the increased expense to stand in the way of increased efficiency. Provided safety in stowage and use can be assured, and provided no danger of explosion need be feared should an oil tank be hit by a shell, there will be positive advantages enough to insure its introduction. The most conspicuous of these is its superiority over coal in evaporative power. A given weight of oil will produce nearly twice as much steam as the same weight of coal, so that in order to keep up the fixed amount of steam required by a naval engine only about half as much fuel need be expended. That means, of course, nearly doubling the ship's radius of action, which is a point of high importance to war vessels. In the case of the London and Pacific company's steamship Ewo, it is said that while she had made eight and one-half knots with the use of seven tons of coal per day, she reached nine knots on less than four tons of fuel oil. It must also be noted that a ton of coal occupies about one-eighth more space than a ton of oil residuals. Hence the customary proportion of 7 to 4 in favor of the evaporative power of oil is increased to nearly double in a ship's fuel supply.

In a recently published review of the present state of the oil fuel question by Assistant Engineer Allerdice of our navy, stress is laid on the fact that petroleum refuse, or the residuum after refining, is used instead of crude petroleum, which would be much more dangerous. Italy, which is well-known to be enterprising in naval matters, has employed a mixed fuel of coal and petroleum on her man-of-war Messaggiero, whose speed was thereby increased from 15 knots to 17, but at some cost of injury to the boilers. Like trials at Spezia on the Castelfidardo and the Ancona have also been favorable. The oil thus used is petroleum refuse, which stands a fire test of about 300 Fahrenheit. Two competitive locomotives were run for five months on the Oroya railroad in Peru, pulling equal trains alternately over the same ground, and being exactly alike except that one used coal and the other oil for fuel. The consumption of oil per mile was 38.55 pounds; that of coal was 79.3 pounds. As a result, that railroad and one other are using oil for fuel. Indeed, along the South American coast some of the most striking instances of progress in this direction are found.

This consideration of the subject by Mr. Allerdice includes a citation of the views of Capt. Carmichael, the commander of the Ewo, already spoken of. He says that the petroleum residuum is perfectly non-inflammable until heated to 350 degrees, and consequently is safe to carry and use; that it has no smell, does not evaporate perceptibly, and does not deteriorate in metal tanks or injure them. The engineer can get the steam he wants without being dependent on firemen or on the state of the weather, and the pressure on the boilers is steady and constant. There are no fire doors to open in coaling, and in the Ewo the tubes were only swept once in six months, and even then were not dirty. Large tank steamers could fuel a fleet, even in heavy weather, by the simple apparatus of hose and pump, whereas coaling at sea is a difficult process. Capt. Carmichael especially dwells on the safety of oil fuel, and its being "handled without risk of fire or explosion," while if stored on shore and bombarded by a fleet "shells could not set fire to the tanks." Of course combustibility is one of the great points to be considered, although it has sometimes been urged that, even admitting this liability, it could be obviated so far as danger from an enemy's shells is concerned by storing the oil under the water line. But bunker protection, now a great element in naval construction, would be sacrificed entirely by using oil for fuel. The cost of oil is admitted to be greater, but this is partly offset by a reduction in the number of the firemen and in the expense, also, of their provisions and quarters. It is also evident that since there are no ashes to be disposed of and no tubes and grates to be cleaned the work of the stokers is much reduced. The total absence of smoke is as obvious an advantage as smokeless powder for armies, and it would aid alike in creeping upon a foe undetected and in escaping.

THE Maine's engines were tested, while the 6,648-ton armored cruiser was in the East River, New York, on Monday week, last. Secretary Tracy and Engineers Melville, Baker, Morley, and Kaffer of the Navy Department were present. The trial was eminently successful. The engines of the Maine are the largest of their kind ever built in this country.

Bro. John Price, 2952 Champa st., Denver, Col., has been appointed Deputy Supreme Chief (A. O. S. E.) for the State of Colorado.

LONG WORDS.

Very long words are now the rage, and it is wonderful how all the leading papers are taking them up. The start was recently made at Boston, by resurrecting scraps of a long word invented in Liverpool, Eng., when velocipedes first came into use, and they called the rider of the wheel, velocipedestrianisticalistinarianologist. Then the English vainly boasted that they had the longest word in existence, when the Welsh came out with the old name of a parish near Dolgelley, North Wales, which name is always spelled out in full whenever the lawyers issue legal documents pertaining thereto; and it is much longer than the new English word. It is contained in the paragraph quoted below, so we need not repeat it. But in common conversation, it is called Llanfairpwllgwyngyll. That is its abreviated form. The terrific name was brought forth by *Engineering* (London), in connection with its report of the Cardiff (Wales), meeting of the British Association last August. Other papers have followed suit, and taken the long word (and its introduction as given in *Engineering*) without credit, as follows:—

A Welsh Sewer.

Mr. G. Chatterton, of the British Association described a new sewer which is now in course of construction. It serves the districts of Pontypridd and Ystradyfodwg—name of terror to Saxon jaw, but not so terrible as Llanfairpwllgwyngyllgogerychwyrndrobwll-llandisiliogogogoch, which is a single compound word, with only one hyphen, and the name of a parish near Menai Bridge. The paper describes the various features in the design, and the method by which they had been carried out. The crude sewage is to be discharged at all times of the tide into the Bristol channel. Work was commenced in May, 1889. About 85 per cent. of the sewer has now been executed. The sewer is egg-shaped 2 ft. by 6 ft. and 3 ft. by 9 ft., with a minimum inclination of 1 in 250. The inclinations will afford a self-cleansing velocity in the invert even when the smallest amount of sewage is passing down. In the course of this sewer it has been found necessary to cross under the river Taff seven times, and this has been accomplished by inverted syphons of cast-iron. In order to obtain a sufficient velocity through the syphons at times of minimum flow the diameter has been reduced to 33 in. and the syphon chambers arranged so as to give a hydraulic inclination of 1 in 100. The Glamorgan canal has also been crossed by means of a similar syphon. There are also eight railway crossings. The outfall sewer passes at a shallow depth for a number of miles through land well suited for irrigation, and it is proposed to offer farmers on the line every facility for pumping the sewage on to their lands. The total cost of the scheme will be about 150,000*l*.

"KORN IS KING."

Corn is being spelt with a K in the above caption which is to be found in many newspapers that publish articles on the corn shows which now attract attention.

The Sioux City Corn Palace has become a staying institution of which, not only Iowa, but all the states of the Union feel proud. It will no doubt be a prominent feature at the World's Columbian Exposition. This year's Corn Palace (as announced in previous issues) will be open from October 1st to 17th (inclusive) for which great preparations are in progress in the City of the Sioux.

At the Illinois State Fair to be held at Peoria, Sept. 28—Oct. 2, there will be a special corn exhibit, for the best in the various departments numerous premiums are offered. And the list shows how important corn has become in the estimation of the Illinois State Fair authorities.

Verily "Korn is King."

The crop report of the Illinois State Board of Agriculture, just issued, says:—

The cool weather of July has not been favorable to the growth of corn, as is evidenced in the lower condition August 1 than on June 20. The June 20 condition was 94 per cent., while that of August 1 is but 83.

The August 1 condition in the northern division of the state is 87 per cent., as against 95 on June 20; in the central it is 87 as compared with 93 June 20, while in the southern division there has been a falling off of 18 points, the June 20 condition being 94 per cent., while that of August 1 is but 76 per cent.

The drought of July was much more severe in this portion of the state than further north, and unless rain comes soon the corn crop of southern Illinois will be materially reduced. [The rain came —without explosives, too.]

Although the corn is from ten to fifteen days late all over the state, the condition is so good and the growth so strong and healthy, that if early frosts do not cut it off, the corn crop of the state will be very fine.

Corn is reported as "firing" in several counties. Clinch bugs are injuring corn somewhat in other counties, and some kind of a worm is working at the roots of the corn in Whiteside, Winnebago, Boone, Carroll, Adams (where all the sweet corn is more or less injured), Bond, Edwards, JoDaviess and Kankakee counties. The oats louse is reported as working in the corn in Winnebago county.

The area in corn this year as reported by the assessors is 5,862,218 acres, a decrease from the 1890 area of 252,008 acres. So many counties, however, sent in incomplete returns that it is altogether probable that if full returns had been made the area would be even larger than last year.

CURE OF DYNAMO AND MOTOR TROUBLES

Although the modern text books on electricity aim more and more at presenting the subjects treated in their practical bearing, it is none the less true that they must necessarily fall short of the ideal in this direction, says the *Electrical Engineer*, (N. Y.), for, however much an author may seek to treat the subject as it presents itself in actual practice, the limits of his work necessarily compel him to curtail this side of the subject in order to preserve the continuity of the work. If to this we add that comparatively few writers have enjoyed comprehensive "practical" experience, which alone can make their work of genuine value to the student, the reason for the complaint that the text books are not "practical" enough will be apparent. The literature of the steam engine affords many excellent works of this practical character, but up to the present time no work has so far been forthcoming which will enable one, by direct application, to install and care for a dynamo or motor. It is true that numerous rules and directions intended for this purpose have been issued by various companies and a very good digest of the "Diseases of Dynamos" was once made by Prof. Silvanus P. Thompson, but none of these afforded the engineers in charge of dynamo electric machinery that sufficiency of information which makes them independent of the "expert," who may be a thousand miles off. To place the average dynamo and motor attendant in possession of such information will therefore be acknowledged to be a work not only of immediate benefit to a large class of station employees, but will also prove of especial benefit to those in charge of issolated plants and who are usually entirely at sea when the slightest mishap occurs in the operation of the electrical plant. It is with the object just mentioned in view that Pro. F. B. Crocker and Dr. S. S. Wheeler have taken up the subject of the care of dynamos and motors, and have, we believe, for the first time, subjected to systematic treatment a subject which may well claim the attention of the ablest minds. In the publication of their work, which will begin in our next issue, the authors first take up that part of the subject which will at once appeal to the dynamo or motor attendant, and which above all others he will most likely have occasion to refer to on future occasions, namely, the localization and remedy of "troubles." The method adopted in presenting this subject will recommend itself by its logical and effective character. The authors first group the various troubles under eight general heads, which are subsequently taken up in detail. Thus the search for a remedy is at once narrowed down and application can be effected with the shortest possible delay. Many of our readers will without doubt be able to recall instances of "trouble" which required days and weeks to localize and to remedy, but which would have been disposed of in a fraction of an hour with the aid of a guide such as that of Messrs. Crocker and Wheeler. The long experience of the authors both in designing and in the practical operation of dynamos and motors gives to their work that character of "practicality" which will cause it to be welcomed by all engaged in the operation of dynamo electric machines.

NEW UNDERGROUND RAILWAY SYSTEM.

(From a London Correspondent.)

A rather novel and at the same time ingenious parcel exchange system has been devised by Mr. A. R. Bennett, a member of the Institution of Electrical Engineers and a gentleman who is well known in connection with telephony in the United Kingdom. In many of the large towns of this country the vehicular traffic is so heavy that in order to avoid absolute blocking of the thoroughfares, the collection or delivery of goods is forbidden in some localities during certain hours of the day. The results of this restriction are that trade suffers and warehouses have to be made of larger capacity than would be necessary if the free receipt and dispatch of goods were permitted. With a view to overcome this difficulty and to allow of comparatively small packages being handled at all times, Mr. Bennett has worked out a scheme (which is founded upon the "telephone exchange" principle) by which parcels could be readily interchanged any number of buildings, no matter how widely apart they may be situated. It would occupy too much space, says a London correspondent, to enter into the full details of the proposed system, but the following brief resume may be found interesting.

Mr. Bennett proposes to effect this system of interchanging by the establishment of a number of miniature underground electric railways, radiating from a central station and having branch lines or sidings into all the buildings to be served. According to this plan the railways would be laid in tubes of a rectangular section and would be so arranged that the down track would occupy the lower portion, and the up track the upper portion of the tube. The tubes would be made sufficiently large—Mr. Bennett proposes 2 ft. wide by 3 ft. high—to allow of a man to creep through for examination and repairs, and in order to afford space for this the rails would not be laid on cross sleepers or ties, but on brackets fastened to the walls of the tube. Tracks actuated by electromotors would run on the rails, the current being obtained either from one of the latter or from a separate conductor laid parallel with the track. On the down journey, the current would be collected by a kind of shoe pressing against the under side of this conductor; and on the up journey by a second shoe or collector. Separate collectors are, however, provided so that a truck could not travel in the wrong direction. The size of tube suggested by Mr. Bennett would permit of trucks 20 inches wide by 14 inches deep being used, and their length might be considerable, but it would be regulated by the radius of the curves. Each train would consist of a motor truck, and one or more trailers or other trucks. The generating and operating station would be established in a suitable locality, and in a large town there might be several. The station would contain the boilers, engines and dynamos and might also be used as an electric light station. Here would be arranged various turntables for the interchange of trains between the tubes, while sidings would be provided for empty trucks.

Coming now is the interesting point of delivery of goods, Mr. Bennett says that connection with the premises of subscribers would be made by short spurs or sidings diverging from the nearest main tube. At the junction of the branches with the main tracks, switches (similar to ordinary railway switches) would be placed and controlled by means of electro-magnets by the operator at the central station. Various methods of finding and working any switch with certainty and rapidity are proposed, and also for ascertaining that the switch has been put over or *vice versa*. The sidings into subscribers' buildings would consist of down and up tracks, but where space is available they would be caused to diverge after entering the building and ultimately meet on one track, so that trains might be shifted from the down to the up track without lifting them off the rails. Various arrangements

are provided for signaling and for informing the operator or operators of the position of the trains, and for the return of loaded or empty trucks from subscribers' sidings or on the main up line. The starting levers could be interlocked with the levers controlling the siding switches so that a following train could not leave until the switch for the preceding one had been restored to its normal position.

This scheme which was fully set forth and illustrated by diagrams at the Cardiff meeting of the British association, is rather startling, but Mr. Bennett considers that the details do not comprise any device which has not been thoroughly tested in the telegraph and signaling departments of the post-office and railway companies or in connection with electric traction. He is of opinion that the system of electrical parcel exchange as proposed would be of the utmost value to the various post-offices and to parcel receiving and great dispatchers of small packages, buyers could, he says, telephone for samples, hotels and restaurants could telephone for and receive in a few minutes supplies they may be short of, and so on. As a parting shot, Mr. Bennett gives a friend's suggestion that a mother could send her baby bodily to the doctor *via* the central station and receive it back "with a bottle of medicine in its fist and a mustard leaf on its chest."

TIN PLATE WORKS IN AMERICA.

Tin is here, and evidently on the increase. The Britishers may, perhaps, prevent Russian warships passing through Hellespont, but they cannot prevent Americans from going into the tin business—and on a large scale, too.

One of the Messrs. Lewis, of the Lewis Sheet and Tin Plate Co., favored us with a call this week, and from what he says (and he ought to know) the Welsh tin men are preparing to leave the old country in great flocks, and by the end of this year they will be working in the United States in great numbers.

The *American Manufacturer* has this to say on the tin plate situation:

It is folly for any one to assert that we are not now making tin plate, or that in all probability we will not make in the very near future much more than the minimum amount mentioned in the tin-plate clause of the McKinley act. The United States Iron and Tin Plate Company are making 100 tons, or say 2,000 boxes, a month; the Apollo Sheet Iron Works, which have sent us samples of their taggers and terne plates, state that they are making 100 boxes a day; Fleming & Hamilton of Pittsburgh make about 50 boxes a day; N. & G. Taylor of Philadelphia, 40 boxes; Marshall Bros. & Co. about 100 boxes, and Niedringhaus some 50 boxes. This makes a total of at least 340 boxes a day—a small amount, to be sure, but an earnest of what is to come.

In addition to this a large amount of black plate for manufacture into stamped goods, which will be tinned after manufacture, is being sold by our rolling mills. This amounts in tonnage to much more than the tonnage of tin plate actually made, and under the law will count as tin plate.

As to the future: Niedringhaus is actually erecting works with the capacity of 600 boxes a day, and will increase this to 2,300 boxes. As we announced last week, the United States Iron and Tin Plate Company have contracted for machinery to increase their output to 6,000 tons of tin plate a year. This is 120,000 boxes, or, say, 250 a day. Norton Bros. are building a mill that will give 200 boxes a day at the start. The Lewis Sheet and Tin Plate Company expect to have their works, which will make 1,500 boxes a week, ready by the last of September, and to increase to 6,000 per week later. Laufman is increasing his capacity to 400 boxes a day. Somers Bros. of Brooklyn are building works, as are the Britton Rolling Mill Company, the Ellwood (Ind.) Tin Plate Company, the Irondale (O.) and others. The plants actually in operation or under contract and construction will turn out at least 4,000 boxes a day, and we know of plans (one engineer in Pittsburgh is drawing eight) that are being drawn and estimates of cost submitted for plants that will bring this up to at least 8,000 boxes.

In some cases these plans are for works on entirely new principles, substituting machinery for hand labor, but in most cases our mills have decided to build works, at first, on the most modern Welsh plans, and improve them afterward. The improvement will be in the manipulation of the plate after it leaves the rolling mill. Our rolling mills are as good if not better than the Welsh, and while improvements will be made in these, it will not be by following Welsh practice. Improvements in the tin house can be made at a comparatively small cost, so that it will pay to put in plants on the Welsh system at first, with the prospect of changing them when some skill has been acquired, and when actual work has pointed out the defects of the present system and the direction in which improvements can be made.

CORRESPONDENCE.

Medical Certificates.

Engineers: A. O. of S. E.

BRETHREN:—The secretary and treasurer of the Benefit Fund hereby notifies you all that the Medical Certificates are now in his hands, ready for delivery upon receipt of order and usual fee for same, which has been placed at fifty cents per hundred, which pays for printing and postage.

Now, boys, look well to your own interests and file, with this office, your lists of membership and certificates of incoming members promptly, or you will find me patrouizing the press to find the reason why; and I know your modesty will protect me from such a course. Yours fraternally,

CHAS. E. JACKS,
Sec'y & Treas. "Benefit Fund."

Gifts Acknowledged.

To the Editor of the American Engineer.

SIR:—Buckeye Council is in receipt of 3 samples of Fairbanks' valves from Fairbanks' Valve Co., through Bro. Slusser, for which they will please accept thanks. All the boys are very much pleased with this new valve, and Bro. Slusser has replaced all of his old valves by Fairbanks.

The council also received nice pictures lately from Buckeye Engine Co. and Westinghouse Machine Co. for which we return sincere thanks. The boys of Buckeye are all o. k. Every one is employed and doing well.

E. E. MILLER,
Cor. Engr, Canton, Ohio.

In Memoriam.

MRS. HERMAN C. SMITH.

To the Editor of the American Engineer:

SIR:—We, the members of Akron Council, No. 5, Ohio, are called upon to perform the sad duty of recording the death of Bro. Herman C. Smith's wife, who died Sept. 6, and was interred at Youngstown Sept. 8, 1891.

And this Council at its regular meeting adopted these resolutions:—

Whereas, It has pleased the Supreme Ruler of the Universe, to remove from our midst the wife of Bro. Herman C. Smith, therefore be it thus

Resolved, That, the American Order of Steam Engineers, of Akron, extend our sympathy to the bereaved husband and orphans, during this, their hour of sorrow; and be it also

Resolved, That a copy of this be sent to THE AMERICAN ENGINEER, for publication, and a copy spread on our minutes, and also sent to the bereaved family.

D. W. GAMMELL,
O. P. KINTZ,
C. P. BROWN,
} Committee.

100 MILES AN HOUR AGAIN.

There is a man in Philadelphia who has a scheme to compete with that which we published in a recent issue. He is none other than the master mechanic of the Philadelphia and Reading R. R. He claims that he can build a locomotive to run at that rapid rate. In reference thereto the Philadelphia *Record* publishes the following:

"If the new engine I am about to have constructed is not capable of making 100 miles an hour I'll give her away to the first person I meet."

This astounding statement was made yesterday by Mr. Jackson Richards, the master mechanic of the Philadelphia and Reading railroad, who was exhibiting to a party of deeply interested persons the drawings for a locomotive which, if successful, is almost sure to revolutionize the construction of the high-speed locomotives of the future. Mr. Richards, who is recognized all over the United States as having no peer in knowledge concerning locomotives and railroad machinery, has been working on his latest invention for the last ten years, and a few days ago the drawings were completed and the patent was applied for.

The new invention will enable a gigantic stride to be taken in the matter of high-speed locomotives, and if the new flier is as successful as experts predict she will be, it is more than likely that the time between Philadelphia and New York will be made in less than an hour. A specimen engine will be built for exhibition at the World's Fair, and the trial trip will be made between here and that city.

In outward appearance the new locomotive will not differ materially from the speedy engines now used on the Philadelphia and Reading railroad between this city and New York. The peculiarity of construction lies in the fact that instead of the two cylinders as used at present there will be four. One cylinder will be located on each side of the locomotive frame as at present, and the other two will be cast in what is known as the cylinder saddle. The inside pair of cylinders are to be in one piece, and will lie on an angle. The outside cylinders are to be horizontal as at present. The four cylinders will entirely overcome what is known to engineers as the dead center, and the engine will be perfectly balanced without any counterbalance in the wheels. This latter improvement will, to a large degree, do away with the pounding which has proven so destructive to modern road-beds. The perfect balancing of the engine will be largely due to the working of the two cylinders so near her center, and these same cylinders, working as they do, from such a central point of vantage, will help out in the matter of speed to a great degree.

According to the experts who have examined the drawings the valve motion is perfect. There will be four valves—one to each cylinder—and they will be operated by two links, the same as now used for two cylinders. The engine is designed to be built on the Wooton fire-box, the same as is now used on the famous "206," which made a mile in the remarkable time of 39 4-5 seconds Aug. 27. The ordinary speed of the destined world beater will be eighty-five miles an hour.

THE GROWTH OF ELECTRIC LIGHTING.

This is the subject of a leading article in the *Electrical Engineer* (London) of Sep. 4, which affords food for reflection. Here it is:

Quite recently the *Times* had an excellent article to show that the progress of electric lighting in England, and especially in London, was very favorable, even when compared with the progress in the States. One point in the *Times* article seems to have struck some persons as hardly correct. The slow progress after 1882 has usually been attributed to Chamberlain's Act of that year. The *Times* says not so, but to the fact that electrical knowledge was not sufficiently advanced to give what was required. Mr. Massey rather supported the contention of the *Times*, while Mr. Crompton, in a long communication in the issue of last Saturday, waxes somewhat indignant that anyone can imagine the fault to be anywhere but in the Act of Parliament. After all, any discussion upon the point can be of no earthly value. Opinions differ, and many people incline to the view that much may be said for both sides, and that each is partly right and partly wrong. So far as electric lighting is concerned comparisons are odious, and comparisou with American progress especially is not worth the paper it is written upon. The conditions existing in the two countries were and are so diametrically different that there might be plenty of incentives to install one artificial light in one place, while there exists quite as strong an incentive to install a different artificial light in another. A town that has no artificial light, or where gas is from 10s. to 20s. per thousand, does not look upon electricity in the same way as when gas is fully installed and costs 2s. 6d. or 3s. 6d. per thousand. It is of little use either to flog a dead horse or to flog a willing horse, and it is

of just as little use to attempt to prove that a town in England ought to follow the lead of a town in America, without stating exactly the conditions prevailing at both places.

There is one phase in the history of electric lighting that is never, so far as we know, sufficiently acknowledged by speakers and writers. We have more than once had occasion to ridicule the claims Americans have made for Edison as an inventor, but we are prepared to admit—nay, claim—for Edison, above all men, the position of having first shown that electric lighting on a large scale was practical, and worthy of commercial enterprise. While Englishmen were pottering about—some with this detail and some with that, none, however, troubling about lighting as a whole—Edison was busy working out a complete system, giving due attention to motors, dynamos, mains, and lamps, endeavoring to make every part fit and and work smoothly as a whole. It matters not that the dynamos of that time, as compared with the dynamos of the present day, partook somewhat of the nature of leviathans; the New York installation from a central station was a practical success.

A consideration of the work that Edison did in America will go far to prove Mr. Crompton's contention, at any rate, to be partially correct. He says: "I do not think, however, I shall be contradicted when I state that in 1883, the year after passing the Electric Lighting Act of 1882, our knowledge of the subject was sufficient to enable us to design central stations on what is known as the low-pressure system, which, in all important respects, were absoluttly identical with those that have been since designed and carried out, on the triumphant success of which your correspondent so ably comments." On the *Times* side of the question we have quite as pertinent facts. Some ten millions of pounds were asked of the public, the greater portion given, and not twopence farthing spent in lasting work, or work that Mr. Crompton would acknowledge as coming under the head of electrical engineering. Surely, the *Times* might argue, if the knowledge was as great as Mr. Crompton says it was, something ought to have been done by somebody. Large installations were promised, but not executed. It was not altogether a question of money, for the money was forthcoming, though the work was not. Would it not be best, therefore, to shut our eyes as far as possible on the past, and look more closely on the present and the future?

The Government and shipbuilders helped to stem the crisis in the demand for ship lighting, Edison on the other side and the Grosvenor Gallery on this side prevented absolute failure, and now a healthier tone prevails. True it is that from time to time a more or less extensive promoting swindle takes place, but at the present time promoters have to provide something for working capital, and not take all the money subscribed as legitimate spoil.

The rays of happiness, like those of light, are colorless when unbroken.

THE DYNAMO AND ITS WORK.

The first dynamo-electric machine ever constructed was that made by Faraday. This great physicist, the prince of experimenters, as he has been called, discovered that when a disk or flat plate of copper was made to rotate between the poles of a powerful magnet, currents were produced in the plate from the center outward. By making a wire touch the revolving plate with one of its ends, and bringing the other one in contact with the rim, he found that a current of electricity passed along the wire and could be made to indicate its existence by deflecting the needle of a galvanometer, decomposing a chemical solution, or by any of the well-known effects produced by electricity in motion.

Faraday saw the importance of this discovery, and the great uses in the way of practical application to which it might be put, but he did not himself stay to develop it; he left that to others, and with it the wealth which might thus be acquired, and himself went on to investigate other obscure and little known phenomena connected with physics and electricity, regarding this as his proper work, and exhibiting in his conduct the true scientific spirit. When, many years afterwards, he went to see the first application of this discovery of his to the production of the illumination of the North Foreland Lighthouse, he said, after looking at the large magneto-electric machines there: "I gave it to you an infant; you have made it a giant."

Dynamo and magneto-electric machines consist essentially of a coil of wire—"the armature," as it is called—rotating between the poles of a large magnet, the poles being bent round so as to approach each other and have the armature between them. This magnet may be either a permanent magnet of hard steel or an electro-magnet, consisting of wire coiled round a soft iron core, a current of electricity being made to circle round the wire coil, and thus magnetizing the iron core while it lasts. It is the latter arrangement which is almost universally used now, though the magneto machines with permanent magnets were the earliest form.

A magnet produces an influence in the neighborhood around it, and this surrounding neighborhood is known as the "field of force," of the magnet—*i.e.* the sphere in which its influence can be felt. A magnetic needle or a bit of iron-filing placed in this field sets itself to point along the "lines of force" of this field—that is, the lines along which the magnetic force acts, and which form curves round the magnet, running out, as it were, from pole to pole, and curving round to the other. Any one may see the form of these lines of force for himself, by placing a bar-magnet underneath a sheet of paper, and then sprinkling iron filings on the paper.

On tapping this the filings will set themselves along the lines of force in beautiful regular curves. Here the small fragments of iron are themselves made magnets while under the influence of the powerful magnet in whose "field" they are, and therefore place themselves lengthwise along the lines of force, that is, along the line of action of the resultant magnetic force at the place where each one is.

When a coil of wire or armature is made to revolve rapidly in the strong field of force which occupies the space between the poles of a powerful electro-magnet, currents are produced in the coil. These currents alter their direction through the coil every time the latter changes its position with reference to the poles of the magnet. The side of the coil which was opposite the north pole is after half a revolution opposite the south pole, and the influence of the south pole tends to produce an opposite current to that of the north pole. Here we have an "alternate current" dynamo machine.

As the coil or armature rotates with great speed, some hundreds of revolutions per minute, these currents, in alternating directions, succeed each other very rapidly, and if an electric arc-lamp is placed on the circuit it will be lit up. In this case it is not necessary that the current be sent round the circuit in one direction only, but although the terminals of the lamp are constantly changing their polarity, that is, the north pole where the current enters the next instant becomes the south pole where current leaves, yet, as this occurs many times in one second, the effect produced is the same as if the current were in one uniform direction.

The lamp has no time to get cool; it does not go out before the oppositely directed current passes through it and produces the same effect as the previous one. No flickering is observable. The impression produced by the glowing carbon on the human eye is retained by the retina for a far longer period than the duration of one surge of electricity through the lamp, and is not gone before the effect produced by the succeeding opposite wave makes its impression on our nerves. The Jablochkoff lamps used lately on the Thames embankment are meant for this system of electric lighting with alternating currents.

In a "continuous current" dynamo, which is necessary for some purposes, such as electrotyping, where the effect desired could not be produced if the direction of the current were continually altering, the electric current is made to pass always one way round the external circuit. This result is got by using the ingenious device of a commutator, which automatically deflects the current so as always to send it in an unvarying direction through the plating bath or the electric lamp, as the case may be.

This commutator consists simply of a split tube, which is attached to the revolving armature, and may be seen in any dynamo working on the continuous system. This tube revolves with the revolving armature, and it is divided by an insulating substance into two parts; each half is alternately on the left and right of the space between the poles of the magnet and the "brushes," which collect the current from the armature, *i. e.*, the bundle of copper wire spread out like a brush, which forms each end of the outer circuit, are fixed in position, and the revolving commutator attached to the armature brings alternately one of its half-tubes into contact with a brush. Thus the half of the commutator which receives the current changes at the same time that the direction of the current through the coils of the armature is reversed; in this way the current sent out to the brush which receives the electric current from the armature is always in the same direction.—*Knowledge*.

WHISKY, VS. A LEVEL HEAD.

Theodore Temple says: There is a vast amount of drinking in Wall Street. Brokers will rush out of the stock exchange on a day of excitement to gulp down cocktails to bolster up their nerves and give them "whisky courage." But they are the small fellows, who come and go, make money one day and lose it the next, and by the time they are middle aged men, and even before, they pass away burned out and broken down in nerve, if not in mind. The great leaders, the permanently successful men of Wall street, are not found among them.

These, almost invariably, are sober and abstemious men; for they want all their wits about them at all times. They are afraid of "whisky courage," and leave it to the fools whose folly contributes to their wealth.

Jay Gould does not drink cocktails, neither does John D. Rockefeller, the president of the Standard Oil Company, and one of the very richest men in the world, himself at the start was a poor country boy. They are too wise, and they have seen too many examples of ruin through drinking.—*Young Men's Journal.*

ILLINOIS CROP REPORT.

The Illinois State Board of Agriculture have issued their crop report up to the 1st of August, in which it is said that while the area devoted to wheat this season is not so large as in some years past, in which it is an increase over the area of 1890 of nearly 54 per cent. The area injured by Hessian fly, which caused so much alarm during the winter, was so small as not to be taken into consideration, so that the area harvested, 1,871,968 acres, is the same as that sown.

The average yield of 18 bushels per acre, has rarely been exceeded in the State.

The total yield of wheat this year, both spring and winter, is 34,620,828 bushels.

The quality of the wheat is generally good.

While the price obtained, 79 cents per bushel, is not quite so high as in 1890, the price is above the average for the past ten years, and if sold at the prices current on August 1 will return to the producers $27,269,219.

The area in oats this season, 2,934,887 acres, is the smallest area devoted to this crop since 1884. A larger area was sown in the northern division this year than last, but in both the central and southern divisions the area is smaller than in 1890. But the greatest difference is noticeable in the southern division where the area is but 67 per cent as compared with 1890. The average yield per acre was 38 bushels, the northern division producing 40 bushels per acre, the central 41, and the southern but 22 bushels. The county reporting the largest yield was Putnam, with an average yield of 54 bushels an acre, while Richland county gives the smallest average, 12 bushels per acre. The total yield is 113,201,389 bushels, an increase of 37,296,448 bushels over last year. The price per bushel, 28 cents, is not quite so large as last year, but the increased yield makes the total value of the crop over $10,000,000 greater than in 1890, and leaves a very fair profit in the hands of the producer. The 1891 area of barley, 26,375 acres, is the smallest area sown to this crop in twelve years, and the average yield per acre, 25 bushels, while slightly larger than the yield of 1890, is still below the average yield for a term of years. The total yield, 666,472 bushels, is smaller than for any year since

1879. The price obtained, 49 cents per bushel, is a little above the average of a few years past and at this price the crop is worth to the farmer $329,220. There is a somewhat smaller area devoted to hay this season than last, there being but 2,564,291 acres of meadows reported. The weather at the time of hay harvest was very fine, and the crop was gotten in in good shape. While the yield is not quite so heavy as on some years, the quality is excellent. In a few counties in the State the yield of hay was as high as two tons per acre, but the average yield per acre was 1.40 tons, making a total yield of 3,609,732 tons.

At the ruling price at this date (Aug. 1), $6.70 per ton, hay will return to the producers the sum of $24,202,232.

The August 1 condition of Irish potatoes in northern Illinois is encouraging for a full average yield per acre, only 11 counties reporting a condition below the average and but one below 90 per cent, while all of the other counties report a seasonable average or better. In the central grand division the crop is not so promising, the present condition being but 85 per cent of an average. The condition in McDonough county is 50 per cent better than usual at this date, and in a few other counties the condition is up to an average. In southern Illinois the prospect is good for 82 per cent of an average yield per acre. In the following counties in this division an average or better yield per acre may be expected: Franklin, Hardin, Johnson, Pulaski and Union.

STEAM AND ELECTRICITY.

A great deal has been said and written in the last few years about a supposed inevitable substitution of something else for steam power. Electricity is freely described as the coming force destined to supplant steam, the predictors talking as if ignorant of the fact that electricity itself must be accumulated by the aid of steam except in those favored places where water power is available for the purpose. One of the latest substitutes proposed is ammonia, and enthusiastic statements that it is already a success are freely published. But these are doubted by some practical men. Ammonia has been for some time used on a line of French coasting vessels, and their reports show that when everything is taken into the account the running expenses are about as great as when they used steam. And there is a painful uncertainty in regard to the supply of the material which does not exist in the case of water. Also the wear and tear on engines and boilers are fully as great, if not greater, as ammonia exerts a corrosive action on iron and steel, which may prove to be a great argument against its employment, especially at sea.

Hence the experience of those who have tried ammonia is by no means conclusive in its favor as a substitute for steam under ordinary methods of using the latter. But very recently it is announced that an important gain in the use of steam power is effected by mixing the steam with hot air in certain proportions in or near the cylinder. If there be no mistake about this steam is thus placed far ahead of ammonia and all other material thus far proposed as rivals, and we may safely fall back on the proposition that for years to come, if not for all time, steam and water power will be the great force factors. For many uses these may be converted into electrical energy, but that will simply amount to a change into a form more directly available for transmission over long distances. The advisability of effecting such conversion, instead of using the steam or waterfall directly, will depend upon the answer to the question whether or not the percentage of loss in making the change will be compensated by the difference in cost of transmission along a wire or by means of belts and shafts. That is, the longer the distance to which it is desired to convey the power the greater will be the inducement to do so by first effecting the change of form, and electricity will especially come into play where it is desired to distribute force to many users from one central station.

There is, however, one important fact in connection with electrical force that will make it a highly desirable form otherwise than for direct use. It is the cheapness with which it can be transmitted in time as well as space. The ability to store it in moderately large quantity, so that at small cost it can be made available whenever desired, as water can be drawn from a reservoir, must commend it to extensive use in the future. And especially is this likely to be the case where the fall of water can be employed for the purpose of accumulating electrical energy without the necessity of converting it into steam by means of a consumption of fuel. The force in a steady flow of water during the whole of the twenty-four hours, and without even holiday intermissions, can all be stored up in suitable apparatus to be drawn upon during a small part of the time with a loss of only a small per cent of the total. And it is not improbable that ere long this idea will be extensively utilized to collect force from the rise and fall of the waser of lakes and oceans, and even from the ebb and flow of the wind as well as from the more persistent air currents moving in one direction. The windmill has been discarded as a direct motor, where steadiness of movement is required, as for the driving of machinery. But there is no reason why it should not come into extensive play in the future for the furnishing of power to be stored in electrical accumulators which shall be tapped as wanted. Indeed, it is not impossible that long before the close of the coming century the winds will be made to supply a large part of the motor force, and the solar rays a big percentage of the heat needed by man to aid him in his struggle for a comfortable existence. This may be forced upon us by the increasing difficulty of obtaining coal and other fuel, but it may also be reached by the grasp of inventive genius many years before the necessity arises for dispensing with the general use of coucreted carbon for the production of artificial heat.—*Chicago Tribune.*

"The Great Mechanical Problem" is the heading of an article on the same subject in the *American Shipbuilder*, wherein it is said that the engineers of the U. S. Navy, who are a very progressive body of men, are now exercising their minds over the future of steam power and its "possible" substitute, and they are also quietly conducting experiments with the view of determining the chances of any further development in the way of power, speed and other elements that tend to make the mechanical advancement of the age. In recently speaking of the several motive powers one of the engineering experts remarked:

"There is a great deal of nonsense being printed nowadays about the prospect that electricity will soon drive steam out of existence. People forget the matter of first causes. They do not realize the fact that whatever electricity can do or will do, it will, in nine cases out of ten, depend upon steam from its generation. There is but one other way to produce it, and that is water power. When you come to consider the vast tracts of territory that are unsupplied with water power, that are either isolated from seas or streams, or are on rivers without currents beyond the slight motion oceanward, you can see how absurd it is to speculate on the substitution of even water power for steam in the creation of electricity. Now, then, what else is it? There are almost as many answers to the question as inventive minds, but nothing satisfactory has yet been offered. Ammonia is about the best substitute for steam that has yet been tried, but there are doubts of its value. It can do all the work steam does, but it is open to objections. There is a line of French coasting vessels that has used it for some time, and their reports show that, taking everything into account, their running expenses are about as great as when they used steam. The main trouble is that there is no degree of certainty about the supply of material. Ammonia is more difficult to obtain in unvarying quanties than water, and this element of uncertainty is not wholesome. Then, too, the wear and tear on engines, boilers, etc., is about the same, and possibly greater than when steam is used, for ammonia has a certain corrosive influence on iron and steel that must tell in the end. There is another matter of grave importance that is being studied just now, and that is the question of the correct ratio between power and speed of a vessel. The old and standard ratio is that the power increases as the cube of speed. Of course in this calculation the coal consumption is the measure of the power, but it has been calculated that this ratio is incorrect, and we are trying to determine the exact figures, which would be of great value to the mechanical world. We have come to face the unalterable fact that steam pressure has its limits, and consequently that water speeds are rapidly approaching the maximum. The speed of ships has been increased more rapidly in the past two decades than at any other period sine men began to float on the water, going up from 12 and possibly 14 knots in the Sixties to the present average of 20 knots, and a maximum of about 27 or 28.

"It is now practically at a standstill, the only progress being in the increase in the number of the very swift ships without any material advance of the limit. I do not think that the limit can be raised much higher. Steam pressure itself has a limit. It can't be increased without disintegrating the materials with which boilers are constructed. Until we find some other material than the common steel with which modern boilers are made we must be content with our present pressures. There are plenty of materials well adapted for such a purpose, such as some of the new alloys, but they are too costly and rare to be put into boilers. I remember the day when we looked upon common steel in that light. The day will probably come when we can use aluminium and its compounds. At present nickel steel seems to be very promising in this connection, and I should not be surprised if we should be able soon to conduct some experiments in this line."

OBJECTIONABLE "KNOWLEDGE."

The foreman of a room in one of the largest manufacturing establishments in the country told a friend recently the circumstances of his first going to work there, and the brief story contains a moral which it would be well for many a lad starting out in life to lay to heart. He was sent to the foreman of the factory by a friend who was anxious to get him into the employ of the company, and the following conversation took place:

"Well," the foreman said, "I understand you want to come here to work. What do you know about machines?"

"Nothing," the other answered.

"Nothing!" echoed the foreman, in surprise. "You do not mean to say that you never saw a machine, I suppose?"

"I literally never saw a machine work in my life," was the reply, "except a locomotive."

"Where did you come from?"

"Cape Cod."

"Hum!" the foreman remarked, studying the face before him. "I came from the Cape myself. Do you suppose that there is anything in our business that you will not know all about in six months, if you come here to work?"

The Cape Cod man was puzzled how to answer, and contented himself with saying that he was sure he could not tell.

"The truth is," the foreman explained, "we can get plenty of men, but by the time they have been here six months or a year they know so much that we have to send them away. They know a vast deal more than we men who have been here twenty years, and they are mostly willing to tell us all they know, too.

"Now if you think there are things that you cannot learn in a week or two, we should like to hire you, but if you are one of the abominably wise kind, you had better move along and give us a chance to find somebody who doesn't know quite so much."—*Youth's Companion.*

BRIGHT DEVICE OF A SHIP'S ENGINEER.

The emergencies of marine disasters often tax the genius of engineers to an extreme, and the manner in which a large British steamer, with a broken propeller shaft, was set aright not long since at Algiers, is worthy of preservation in mechanical history, says the *American Shipbuilder*. Both the shaft and the tube through which it passed at the stern were broken and the vessel lay in port until the arrival of another shaft and tube from England. It was then found that the tube was larger than the opening in the stern. The tube was fastened to one of the coupling faces of the sound portion of the shaft, just as it would be chucked in a lathe. The ship's engine was run slowly and by means of an improvised slide rest the tube was turned down to the proper size. The tube and shaft were fitted in place, and the steamer resumed her voyage without having been placed in dock, the stern being raised out of water by shifting the cargo forward.

ZINC IN BOILERS.

The British Institute of Marine Engineers at a recent meeting discussed the application of zinc to boilers for the purpose of preventing corrosion. The impressiou was general that zinc should be used not only in the water space, but also in the steam space, while it was stated that the use of kerosene and white zinc are good preventives of corrosion if the steam space is simply painted with the mixture. It was also stated that the greater portion of the corrosion was due to electric action, and that the ziuc, which has an electrical effect opposite to that of iron, is in itself a protection to the plates of the boiler. It is not necessary to employ any complicated electrical appliances to bring about this result, for the mere metallic contact of the zinc plates with the iron is sufficiently effective. In practice each square foot of grate would require four or five pounds of zinc.

LITERARY.

The Transition, Curve Field book, by Conway R. Howard, C. E., contains full instructions for adjusting and locating a curve nearly identical with the cubic parabola in transition between any circular railroad curve and tangent. These instructions are simplified in application by the aid of a general table, and illustrated by rules and examples for various problems of location. There are also valuable tables of radii, sines, tangents, versines and external secants. Iu his prefatory remarks the author says: It was first intended to give three tables for transient curves, beginning with deflection angles for the first chord of one minute, two minutes, and three minutes, respectively; but the former and latter were laid aside for the reason that the advantages of increased convenience and diminished liability to error, in having a single table to refer to, entirely outweigh that of being able to make rather nicer adjustments in a few cases, which is about all that would be gained by using the three tables instead of one. For such transition curves as are needed in practice, the table given, based upon the initial deflection of two minutes seems to be all that is required. And, in fact, this new book seems to contain all that is required, pertaining to the subject, while superfluities are omitted. It is published by John Wiley & Sons, New York; A. C. McClurg, & Co., Wabash ave., Chicago, being western agents. The price is $1.50, strongly bound and gilt-edged.

Montreal Water.

Mr. B. D. McConnell, the able superintendent of the Montreal Water Works, has issued his annual report for 1890, which has been printed by order of the Water Committee. A comparative table is given showing the average daily consumption each month and each year since 1857 to 1890 inclusive. Last year the Montrealites consumed 14,399,712 gallons of water daily, on an average, being an increase of fully a million and a half gallons daily over 1889. The population of the City of Montreal last year is given as 233,000, which with that of five suburbs added makes 245,462, supplied by said water works. This is equivalent to 61 gallons daily for each person. And they are awfully particular about having pure water too. If they were to see the Chicago River now, which empties itself with its great load of oily filth into Lake Michigan (except when it runs the other way), and seeing how well the lake water agrees with the people of Chicago, in spite of it all, they would not be so suspicious about the little sawdust which finds its way into the Ottawa river. During 1889, the consumption of water was much less than usual, over half a million gallons less daily than the year before. They were afraid it contained sawdust. They were pacified, last year, by a report of the assistant public analyst (A. McGill) who said, "As to the fitness of the Ottawa river for domestic uses, I may say that it contains nothing which must of necessity render it unwholesome." Their power plant comprises three turbines, one breast wheel, and two steam engines. The cost of repairs and operation is very low, considering the amount of work done, and shows that Superintendent McConnell and his assistants are managing the Montreal Water Works ,very economically, while doing their work effectively.

BUSINESS TRANSACTIONS.

Hine & Robertson, of 45 Cortlandt street, New York, who are sole agents for the Reliance water alarm columns, and also for the Wainwright water and steam tube heaters, report business very good, in these devices, as well as in the other steam appliances which they handle.

Tht Penberthy Automatic Injector.

The most encouraging reports are received from the Penberthy Injector Co., of Detroit, Mich., manufacturers of the Penberthy automatic injector, regarding their business. They state that while business has been unusually quiet in their line throughout the country, they have continued busy and have been obliged to add several lathes to their factory and increase their working force. There is no doubt but that the simple reasonableness in price and efficiency of this injector, as a boiler feeder, has carried the demand equal to the supply, and while they have been but a few years in business their sales have reached nearly 50,000 machines. They are represented by some large steam supply houses in every large city in the United States, where their injectors can be found.

While overhauling their steam plant, last week, the Brunswick, Balke and Collander Co., replaced the common water columns on their boilers with 3 additional Reliance safety water columns—this after using one of these safeguards for over a year past.

The Sioux City Engine Works report business as fairly good, and the number of orders taken exceed their expectation. They are still running their night force, and expect to for some time to come, in order to keep pace with their rapidly growing business. They have recently taken orders for the following:—

One 18x42 Corliss for Greenville, Miss., parties. This engine will be shipped within a very short time. One 5 & 11x16 compound automatic engine for a mill at Sheldon, Ia. One 12x36 engine for the Eureka Milling Co., of Sioux Falls, S. D. One 11x16 Giddings' automatic for the Stella Corn Meal Mills, Stella, Neb. One 16x36 Corliss for the Capital Wagon Works of Iona, Mich., also a 50 h.p. engine and 60 h.p. Stirling boiler for the Moline Furniture Co., Moline, Ill. The two 12 & 22x36 compound condensing Corliss engines for W. J. Hobson, Waco, Tex., will soon be ready to start and will be the finest plant of its kind in the state, it is claimed.

They have placed 12 large engines east of the Mississippi river during the past three months, and are receiving daily inquiries for their new, large 24x28 Corliss engine of recent design, bed for which has been made especially heavy and stiff for the electric railway trade.

American Agricultural Machines Wanted.

A German wholesale firm, with English and German references, dealing in agricultural machines, wishes to buy for cash American agricultural machines of latest and approved construction and invites cheapest offers to be forwarded to F. A. 7071, care of Rudolf Mosse, Berlin, S. W. (Germany).

CONTRACTS OPEN.

Building Materials.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D C., until the 9th day of October, 1891, for all the labor and materials required for the excavation, concrete foundations, stone and brick work, iron and wood floor and roof construction, roof covering, etc., of the U. S. Post Office building at Jackson, Mich., in accordance with the drawings and specifications, copies of which may be had at this office. Each proposal must be accompanied by a certified check for not less than 2 per cent. of the amount of proposal. Proposals must be sealed and marked "Proposals for Excavation, Concrete Foundations, Stone and Brick Work, Iron and Wood Floor and Roof Construction, Roof Covering, etc., for the U. S. Post Office Building at Jackson, Mich.," and addressed to W. J. Edbrooke, Supervising Architect.

Steam Heating and Ventilating Apparatus.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until the 9th day of October, 1891, for all the labor and materials required for putting in place complete the low pressure, return circulation, steam heating and ventilating apparatus for the United States Post Office building at Kalamazoo, Mich., in accordance with drawings and specifications, copies of which may be had at this office. Bids will also be considered for any other system of heating and ventilating in lieu of the above, and parties proposing to supply such must submit, with their proposal, plans and full specification for same. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal. Proposals must be inclosed in envelopes, sealed and marked, "Proposals for the Low Pressnre, Return Circulation, Steam Heating and Ventilating Apparatus (or otherwise, as the case may be) for the United States Post Office building at Kalamazoo, Mich.," and addressed to W. J. Edbrooke, Supervising Architect.

Steam Heating and Ventilating Apparatus.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until the 6th day of October, 1891, for all the labor and materials required and fixing in place complete the low pressure, return circulation, steam heating and ventilating apparatus, power boiler, pump, etc., in the United States Custom House, etc., building at Galveston, Texas, in accordance with the drawings and specifications, copies of which may be had on application at this office. Bids will also be considered for any other system of heating and ventilating in lieu of the above, and parties proposing to supply such must submit with their proposal plans and full specification for same. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal. Proposals must be sealed and marked, "Proposals for the Low Pressure, Return Circulation, Steam Heating and Ventilating Apparatus (or otherwise, as the case may be), Power Boiler, Pump, etc., for the United States Custom House etc., building at Galveston, Texas," and addressed to W. J. Edbrooke, Supervising Architect.

Iron Work, Etc.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock p. m., on the 28th day of September, 1891, for all the labor and materials required for the iron stairs, iron work, etc., of elevator shaft, for the U. S. Court House, Post Office, etc., building at Denver, Col., in accordance with drawings and specifications, copies of which may be had on application at this office, or the office of the Superintendent at Denver, Col. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposals. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in envelopes, sealed and marked. "Proposals for Iron Stairs, Iron Work, etc., for the U. S. Court House, Post Office, etc., building at Denver, Col.," and addressed to W. J. Edbrooke, Supervising Architect.

SEPTEMBER 26, 1891. The American Engineer. VOL. 22, NO. 13.

NEW STANDARD MEDIUM SAW MILL.

The illustration at the lower part of this page represents a new medium mill placed on the market by the Standard Saw Mill Machinery Co., of Erie, Pa. This mill is designed to combine strength and usefulness at a moderate cost. It has a capacity for about 8,000 feet per day; carrying up to a 60-inch saw, the following being details of its dimensions, etc:—

The husk is of best pine 7 feet 6 inches long, 4 feet wide, 12½ inches deep, 4 inches thick; with 2⅝-inch steel arbor with solid collar 5 inches diameter. Lug pins being 3 inches center to center. Gig and feed shaft pulley 24 inches diameter, 5-inch face. Gig and feed paper frictions 14 inches and 5 inches by 4-inch face. Rag shaft 1½ inches diameter. Rag pinion 4½ inches diameter. Turned spreader 13 inches diameter. Upper feed shaft 1⅞ inches. Three changes of feed for 3-inch belt, feeding from 1 to 2½ inches, but will be changed to suit purchaser.

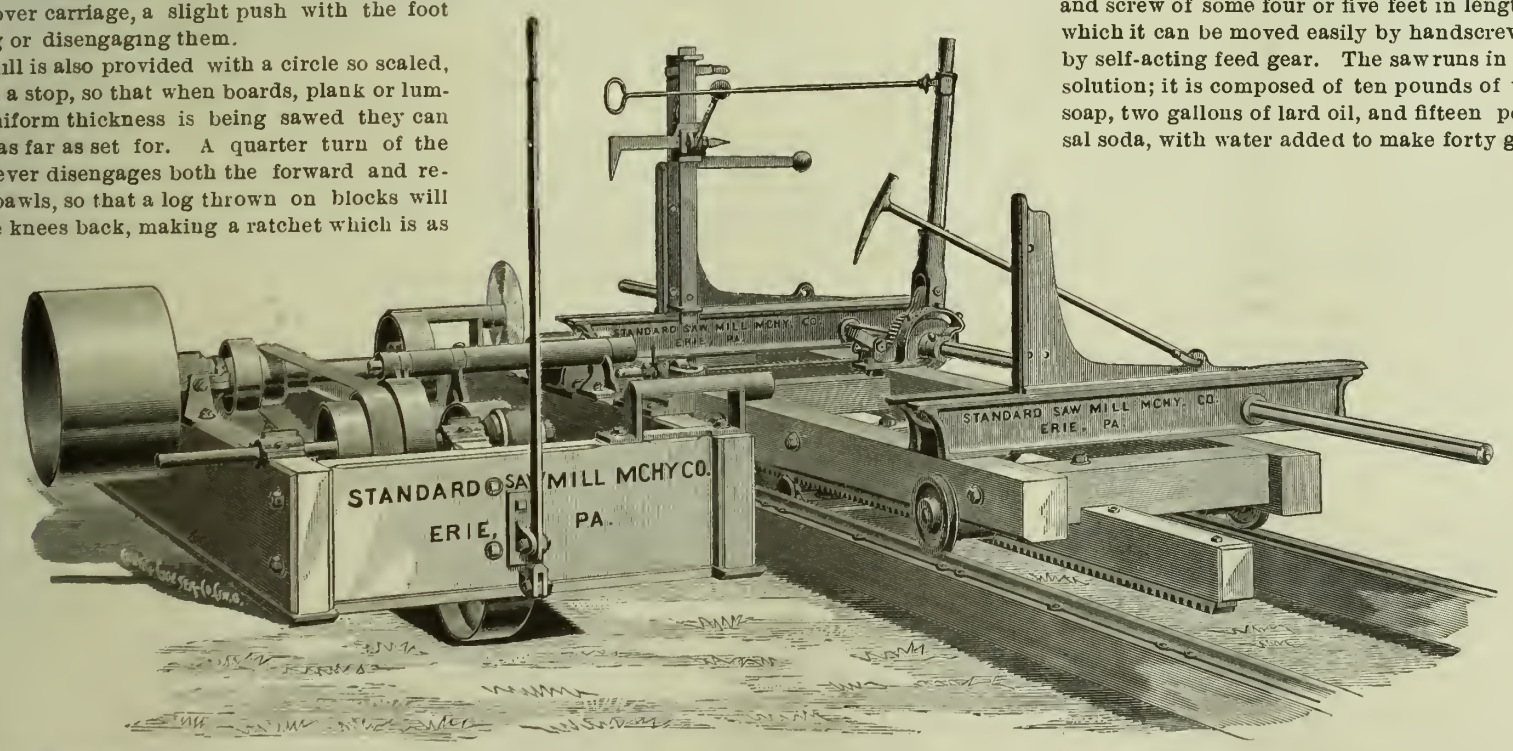
The carriage is twenty feet long, running on six pairs of wheels and axles, or wheels and chairs as may be preferred, timbers of best pine 4½ inches by 5½ inches. Rack stick with rack is 24 feet long, 3½x 4½ inches; with 48 feet of V and 48 feet of flat track; together with necessary screws and bolts complete.

Two blocks are furnished unless otherwise ordered, opening 36 inches from the saw, provided with the new standard rachet. The blocks are made in one piece, with solid knee, one provided with the well known knight dog, combining both log and last board dogs, the other with the common log dog, 16 feet of 1¼-inch set rod, key-seated entire length, with steel knee pinions. These blocks will fit carriages from the narrowest to 44 inches wide ontside.

The ratchet cut (on the upper part of this page) represents the new Standard ratchet, which is made up of a ratchet wheel having 45 teeth, operated by six steel pawls of different lengths, that are raised from the under side by a steel pawl, being operated by a half turn of the setting lever, which, while disengaging the forward pawls, also engages the reversing pawls (also of steel), to enable the sawyer to move back the blocks while at his place at the sawyer's lever; it is also provided with six check pawls which make any back or lost motion impossible. The check pawls are controlled by a lever passing over carriage, a slight push with the foot engaging or disengaging them.

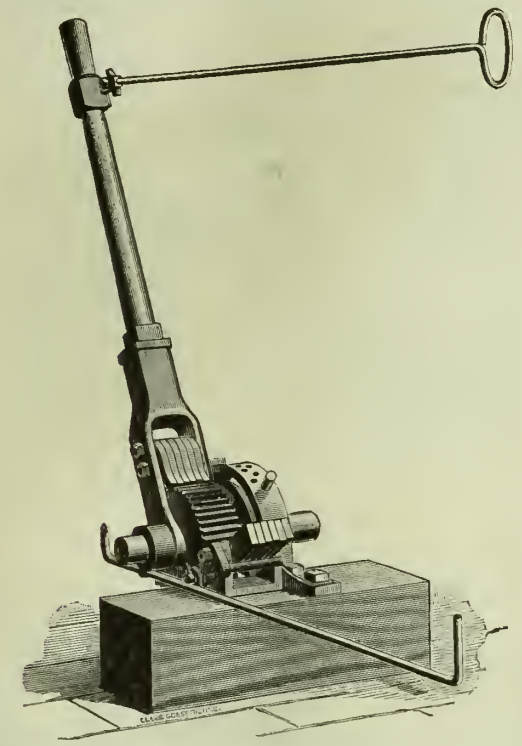
This mill is also provided with a circle so scaled, and with a stop, so that when boards, plank or lumber of uniform thickness is being sawed they can only set as far as set for. A quarter turn of the setting lever disengages both the forward and reversing pawls, so that a log thrown on blocks will carry the knees back, making a ratchet which is as accurate as is used on larger mills, and one which can be set over the log by the sawyer, or behind the log by the setter, with equal convenience and accuracy. This ratchet will fit any pony, small or medium mill, whose blocks are operated by a set shaft.

The Standard Saw Mill Machinery Co. make mills from 5,000 to 30,000 feet capacity, right and left hand, with and without top saws, with belt or variable feet, any length of carriages, swing cut-off saws, gang and side edgers, log and lumber trucks, engines and boilers, saws and belting; and they will be pleased to reply to any inquiries from those who wish further information.



LITHO-CARBON A PERFECT INSULATOR.

Mr. John Wier, of New York, who is at the head of a company organized to develop the uses to which litho-carbon, a wonderful mineral recently discovered in Texas, may be advantageously applied, is in Chicago. He maintains that this newly discovered mineral is destined to work a revolution in many important fields of commerce.



"In the first place, I want it understood that I claim nothing for this new mineral except what can be backed up by experiments that have already been made," said he. "Vast layers of this new material have been found in Central and Southwestern Texas. It is of dark brown color and of a spongy or rather clayey consistency. The broad veins in the ground appear to be a mass of sea-shells, held together by sand covered with a dark, sticky film of the color of dark brown sugar. It has no taste and no odor. The veins of the new material range from two to forty feet in depth. In most places it is near the surface of the ground. Samples of this new material were examined at first by a number of chemical experts in New York, and none of them could tell what it was. The new material resisted completely the action of water, heat, acids, and alkalis, and that proved that if the secret was once learned the new material would be a startling discovery.

"Finally one chemist applied a bath of common benzine to the new material, and that had the desired effect of separating it into two parts—one the white sand and sea-shells, the other the new material, which was of a brilliant black color and had the consistency of cold molasses.

"Now, as to the uses to which litho-carbon can be applied: It has been proved that it will make the most perfect insulator yet known. I have a certified statement from Prof. Hamilton, the electrician of the Western Electrical company, saying that under the most exhaustive tests a wire having a covering of this litho-carbon revealed a resistance of over 7,000 meghoms per mile. No other wire known shows a resistance of 1,000 megohms per mile. You can take the simple naked wire and soak it in a liquid made from litho-carbon until the wire is merely covered with a film, and it will then stand proof against 600° Farenheit, and besides this the thinnest film insures perfect insulation. The litho-carbon may also be used as a paint that will resist the action of heat, salt air, salt or fresh water, or gases of any kind, and can also be used as a varnish with the same result.

"The new material will soften under the influence of enormous heat, but it cannot take fire and burn. It can be rolled into a tissue or large leaves and be used in the manufacture of goods that are entirely waterproof, and for this purpose is especially desirable because it is odorless."

THE POTTER SAW.

A new cold saw for sawing iron and steel has been invented, known as the Potter saw, and has been introduced with great success in Pittsburg, says a contemporary. It is a circular saw of fine steel, tempered somewhat hard, and about one-quarter of an inch in thickness at the periphery, and ground slightly thinner at its center to clear itself easier in a deep cut; it is made to revolve at a slow speed, while the old hot saw was run at a high rate and did its work by means of the intense friction created rather than teeth, so that the new machine cuts but one inch a minute. It also differs from the ordinary circular saw in this respect—namely: that it is not the work that works up to the saw, but the work is fixed stationary and the saw is made to travel along the table through it. It is driven by a worm wheel and screw of some four or five feet in length, along which it can be moved easily by handscrew gear or by self-acting feed gear. The saw runs in a tank of solution; it is composed of ten pounds of whale oil soap, two gallons of lard oil, and fifteen pounds of sal soda, with water added to make forty gallons.

UNDER MANY ALIASES.

P. H. Zwicker, who claims to live at No. 2316 No. Eleventh street, St. Louis, and who has given to the Chicago police no less than three other names since he was locked up by them, at the Desplaines Street Station charged with forgery. The police are investigating his record.

We publish the above statement at the suggestion of a Chicago engineer. He thinks several engineers may become interested as the case develops.

THE CROCKER-WHEELER PERFECTED ELECTRIC MOTORS.

Probably no greater advance has been made in any branch of electrical machinery than that noticed in the construction of electric motors.

No single concern has labored more successfully in this field than the Crocker-Wheeler Electric Motor Company, 430-432 West 14th. street, New York, makers of the celebrated Crocker-Wheeler perfected electric motors. They have turned out a line of motors, and special standard applications of the same, which, as far as is known, are made just as such machines should be, to wear well and do their work satisfactory. They are made without regard to cost of material or labor, and are so designed that they do the regular work at a much slower speed than has been possible heretofore. They have their parts so formed or arranged as to prevent all the troubles which a number of years of experience have shown were liable to occur to electrical machinery.

These perfected motors have many special advantages which can be found in no others.

The field magnets are composed entirely of the best wrought iron, each magnet being forged in a single piece, and set deeply into the base, thereby securing great solidity and ample magnetic contact. The space for wire on these magnets is perfectly cylindrical in the form of an ordinary spool, thereby insuring smooth and perfect winding of the wire, and is short in length, permitting the shaft of the machine to be low enough to free it from vibration. By this construction, the neutrality of freedom of the base from magnetism is secured, and there is no tendency to leakage, making the machine much superior to all those in which the base is made to serve as one of the pole pieces, as the bearings then become magnetized and make the shaft bind.

The armatures contain several improvements. They are sufficiently large in diameter to obtain slow speed, and are so designed that the wire winding is embedded below the surface of the iron core, thus protecting it from all injury, holding it rigidly in position, and rendering it possible for the magnets to approach very closely to the core, so that an intense magnetic effect is produced. The armature is mounted upon a brass face-plate which is first turned perfectly true, and after completion the armature is very carefully balanced, so that when run at full speed the motion is hardly perceptible.

The bearings are all of the self-oiling type, and do not require attention oftener than once in two to four weeks. The arrangement of these bearings is shown herewith.

The base of the pillow-block is hollow; and contains a supply of oil, which is carried over the shaft by two rings which travel upon the latter, and are caused to revolve by its motion. They dip in the oil and carry it continuously to the upper side of the shaft.

The bushings or brasses in which the shaft runs, rest in turn in universal or ball joints in seats of babbit metal in the pillow-blocks, so that the bearings are sure to assume perfect alignment when the shaft is introduced. After the motor has run a month, the oil containing the grit, etc., is drawn off from the pet cock at the base of the pillow-block. This cock is then closed, and fresh oil is introduced by removing the thumb screw in the pillow-block cap on top.

The brushes are held by rocker arms which can revolve freely around the entire circle, without fear of the brass connecting parts "grounding" against the frame, a great advantage in special work where motors are to be adopted for use in unusual positions,

With the form of armature core used in the Crocker-Wheeler motors which reaches close to the field magnets, and the high grade of wrought iron used for the latter, we are enabled to maintain the magnetism and therefore the power of these motors with only about one-third as much wire as is used on the fields of any of the heretofore standard machines. This great saving of the wire not only reduces the weight of the machine, but materially increases the efficiency, or the amount of power that can be obtained from a given amount of electricity, for with less wire less electricity is required.

The speed of all motors made by the company is very low. This in many cases, makes counter-shafting, etc., unnecessary, they having preferred to design and construct their machines so as to enable them to give their full power while running slower than others, in order to save the intermediate devices usually necessary for reducing the speed, and because a slow running motor is much quieter, more durable and easier taken care of. The noiseless running is aided by the solidity of the base which is of cast iron in one piece, forming also the yoke of the field magnets. This one casting is the heaviest part of the machine, and, therefore, brings the center of gravity very low, securing steadiness and stability. The proximity of the armature core to the field magnets renders a high magnetic pressure unnecessary, therefore, the magnetism escaping from the fields is very much reduced, so that no perceptible effect is produced at a short distance from the motor, and in this respect it surpasses even the iron clad style of machine.

The best double insulated wire is used throughout for the windings, the cores being first wrapped with oiled paper and heavy canvas saturated with shellac, and the motors are severely tested for insulation, none being passed without an insulation resistance of over one megohm.

The current required by the machine in volts and amperes, its speed, consecutive number, etc., are all plainly marked upon the name-plate. The "constants" of the armature, the number of turns, size of wire, etc., are also stamped upon its face-plate (a new feature.)

The rocker arm is provided with a heavy insulated handle to enable all adjustments to be made without touching the conducting parts, and the entire machine is heavily japanned and baked at a high temperature, thus securing a polished surface which resists dirt and oil.

In connection with the incandescent motors, the Crocker-Wheeler Electric Motor Company furnish fire-proof and indestructible regulating boxes or rheostats for starting, stopping and varying the speed of their machines. These are built entirely of slate, china and iron, handsomely japanned. The arrangements of contacts in the switch on top of the regulator is such that both the field and armature of the motor are charged by the single operation of turning the knob, making it possible to put the current on the armature before the field is charged, which has so often been the cause of accidental burning out of other motors by the use of ordinary regulators.

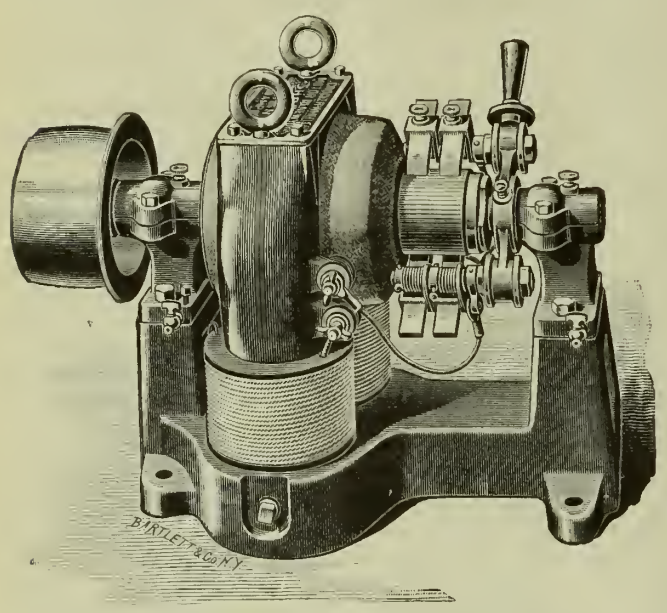
The field is first charged through a small resistance coil which is put in for the purpose of preventing a too sudden change in the magnetic strength of the latter, as well as to divide the spark when the motor is disconnected. The coils used for starting the armature are all of the same size wire, carefully tried for carrying the full current of the machine at all speeds. With the company's fire-proof regulator, the motor can therefore be slowed down and left running at any desired speed, indefinitely, and the usual caution "never to leave the box half turned on for fear of overheating and fire" is unnecessary. The capacity of these boxes is stamped upon them also.

The 5 HP. motor illustrated is a very popular size for running shops, printing offices and elevators, especially direct hoist, its power being sufficient to run at once all the appliances found in most medium sized establishments of this kind.

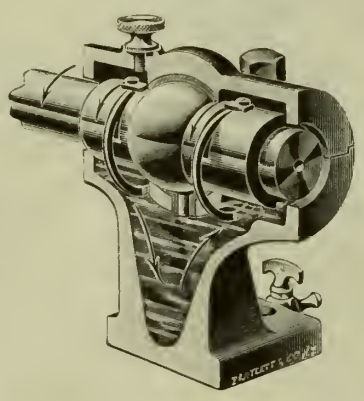
Besides these regular uses, this size is recommended in a great many cases for experimental work. Having a considerable margin of capacity it can be easily wound for special and difficult work. As an illustration, some have been made for 750 volts with low amperage, others to give 100 amperes at low voltage. One of this size now used for electric traction was made to give 45 amperes and 70 volts at the extremely low speed of 500. The motor, used as a dynamo, being in this instance coupled direct to the steam engine shaft.

The dimensions of the standard machines are as follows: Length, 28 inches; breadth, 18¾ inches; height, 21 inches: pulley, 7½ inches diameter, 4½ inches face. Speed, 1,000 or less; weight, 485 lbs.

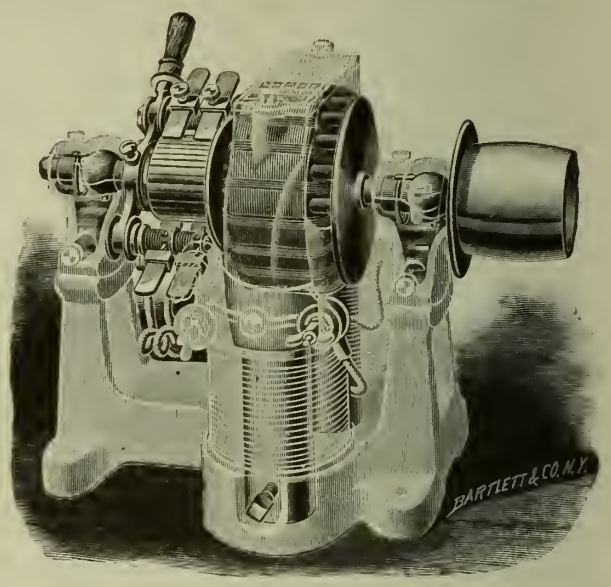
The efficiency of the Crocker-Wheeler motor is higher than that of any before made, on account of the current saving construction described, their workmanship is of the very best throughout, and they are acknowledged by leading electrical engineers, dealers and manufacturers to be most perfect, efficient, best proportioned, most reliable and best looking motors made.



5 H. P. Crocker-Wheeler Perfected Motor.



Detail of Self-Oiling Bearing
Used on all Crocker-Wheeler
Motors from $\frac{1}{6}$ H. P. up.



Details of Perfected Motors.
$\frac{1}{6}$, $\frac{1}{4}$, $\frac{1}{2}$ and 1 Horse Power Type.

THE INTER-STATE EXPOSITION.

The 19th Inter-State Exposition, in Chicago, is at present in "full swing." And now that it is in something like a complete state, the display is very attractive. Many go to this year's exposition with the impression that this will surely be the last time in the old building, and they look on it all as something to be seen never more.

"Items from Russia."—Microbes.

THE LOCALIZATION AND REMEDY OF TROUBLES IN DYNAMOS OR MOTORS.—1.

BY PROF. FRANCIS B. CROCKER AND DR. S. S. WHEELER.

The promptness and ease with which any accident or difficulty with electrical machinery may be dealt with, whether by the inspector of construction or by the operator in charge of running, will always have much to do with the success of the plant and of those dependent upon it. It is therefore likely that any method to eliminate or reduce these troubles would be very welcome to those handling dynamos and motors. With the object of obtaining such a method, we have prepared a list of troubles, symptoms and remedies, based upon quite an extensive experience with the various types and sizes of dynamos and motors in common use.

It is evident that this subject is somewhat complicated and difficult to handle in a general way, since so much depends upon the particular conditions in any given case, every one of which must be included in the table in such a way as to distinguish it from all others. Nevertheless, it is quite remarkable how much can be covered by a systematic and reasonably simple statement of the matter, and we feel confident that nearly all of the cases of trouble most likely to occur are covered by the table, and that the detection and remedy of the defect will result from a proper application of the rules given.

It frequently happens that a trifling oversight, such as allowing a wire to slip out of a binding-post, will cause as much annoyance and delay in the use of electrical machinery as the most serious accident. Other troubles, equally simple but not as easily detected, are of frequent occurrence. In such cases a very slight knowledge on the part of a man having the machine in charge, guided by a correct set of rules, will enable him to overcome the difficulty immediately and save much time, trouble and expense.

It must not be supposed that this method for treating dynamo and motor troubles is given because these machines are particularly liable to such difficulties. On the contrary, no machine in existence is mechanically simpler than the dynamo or motor. The only wearing parts about the machine, with the exception of the commutator and brushes, which are specially made to stand almost unlimited wear without interfering with the action of the machine, are the two bearings. In this respect, therefore, the dynamo or motor is as simple as an ordinary grindstone, and infinitely simpler than a steam engine, which often has a dozen or more oil cups and several dozen wearing parts. Even a sewing machine is far more complicated mechanically than any dynamo or motor. In fact, it would be useless to attempt to give a method for detecting and curing dynamo and motor troubles if it were not for the fact that these machines consist of very few parts, which makes it reasonably possible to locate the trouble.

The rules are made, as far as possible, self-explanatory, but a statement of the general plan followed by its most important features will facilitate the understanding and use of the table.

USE OF THE TABLE OF TROUBLES.

In the use of this table the principal object should always be to clearly separate the various causes and effects from each other. A careful and thorough examination should first be made, and as far as possible one should be perfectly sure of the facts, rather than attempt to guess what they are and jump at conclusions. Of course general precautions and preventative measures should be taken *before* any troubles occur, if possible, rather than wait until a difficulty has arisen. For example, see that machine is not overloaded or running at too high voltage, and make sure that the oil cups are not empty. Neglect and carelessness with any machine are usually and deservedly followed by accidents of some sort.

The general plan of the table is to divide all dynamo and motor troubles which are liable to occur into eight classes, the headings of which are the eight most important and obvious bad effects produced in these machines, viz:

No. 1. Sparking at Commutator.
No. 2. Heating of Armature.
No. 3. Heating of Field Magnets.
No. 4. Heating of Bearings.
No. 5. Noise.
No. 6. Speed abnormally high or low.
No. 7. Motor stops or fails to start.
No. 8. Dynamo fails to generate.

Any one of these general effects is very obvious, even to the casual observer, and still more so to any one making a careful examination, and every one of these effects is perfectly distinguishable from any of the others without the least difficulty. Hence, this classification is perfectly definite and makes it easy to tell, almost at the first glance, under which one of these heads any trouble belongs, thereby eliminating about seven-eights of the possible cases. The next step is to find out which particular one of the six or eight cases in this class is responsible for the trouble. This, of course, requires more careful examination, but, nevertheless, can be done with comparative ease in most cases. Of course one cause may produce two effects, and, vice versa, one effect may be produced by two causes; but the table is arranged to cover this fact as far as possible. In a very complicated or difficult case it is well to read through the entire table and note what causes can possibly apply, and they will generally not be more than two or three, then proceed to pick out the particular one by following the directions which show how each case may be distinguished from any other. The table is intended for the use of those who build, test, install, own or operate electrical machinery, and all statements apply equally well to both dynamos and motors, unless otherwise specially noted.

SPARKING AT COMMUTATOR.

1. CAUSE.—*Armature carrying too much current*, due to (*a*) overload (for example, too many lamps fed by dynamo, or too much mechanical work done by constant potential motor); or (*b*) excessive voltage on a constant potential circuit or excessive amperes on a constant current circuit. In the case of a motor on a constant potential circuit, any friction, such as armature striking pole-pieces or shaft not turning freely, will, of course, have the same effect as overload in producing excessive current. The armature of a motor on a constant-current circuit does not tend to heat more when overloaded, because the current and the heat it produces in the armature ($C^2 R$) are constant. In fact, armature can be stopped with full current without injury except loss of ventilation.

Symptom.—Whole armature becomes overheated and belt very tight on tension side and sometimes squeaks, due to slipping on pulley. Overload due to friction is detected by stopping machine and then turning it slowly by hand. See Heating of Bearings and Noise, No. 2.

REMEDY.—(*c*) Reduce the load; (*d*) decrease the size of driving pulley, or (*e*) increase the size of driven pulley; (*f*) decrease magnetic strength of the field in the case of a dynamo or increase it in the case of a motor. If excessive current cannot satisfactorily be overcome in any of the above ways it will probably be necessary to change the machine or its winding. Overload due to friction is eliminated as described under Heating of Bearings and Noise, No. 2.

2. CAUSE.—*Brushes not set at the neutral point.*

Symptom.—Sparking varied by shifting the brushes with rocker arm.

REMEDY.—Carefully shift brushes back and forth until sparking is reduced to a minimum. This may be done by simply moving the rocker-arm, provided the brushes are set so as to touch diametrically opposite points on the commutator. If the brushes are not exactly opposite they should be made so, the proper points of contact being determined by counting the commutator bars or measuring with a piece of string or paper.

To be continued.

SIOUX CITY CORN PALACE.

It is the fifth corn palace that will be opened at Sioux City, Iowa, on the 1st of next month, and will continue open until October 17 (inclusive). Each successive palace is far more excellent than its predecessor, and this "fifth annual festival" of King Korn has unusual attractions. The illustration herewith gives an idea of the outward appearance of the Corn Palace of 1891. Then they have a proclamation device that is worth framing: it is in the form of a certificate, with elegant green border and its language is as warm and charming as an Indian summer. "Know all men by these presents that the City of Sioux City bids you welcome," etc

The Mexican military band has been secured and will give daily concerts in the palace afternoon and evening. This world renowned organization comprises the best musical talent in th Mexican army, and numbers 56 "superb artists." The various Pan-American republics will contribute novel exhibits, and will be accompanied by natives who will observe the manners and customs of their countries and live within the palace in an adobe hut. The decorations both within and without will be on a more elaborate scale than ever, embodying many new and artistic ideas which have not been brought out in former years.

The good citizens of Sioux City seem "tickled to

death" at the great and continually increasing success of their Corn Palace, as may be judged from the concluding paragraph of King Korn's proclamation, which says:

"Excursion rates will be made from all parts of the country giving the people of this continent an opportunity to visit the Corn Palace, and to see for themselves the future great city of the Northwest with its wonderful achievements and boundless possibilities."

Not only is Sioux City very enthusiastic, and bids everybody a most hearty welcome, but they evidently do their "level best" to entertain all visitors in a style that will make all remember King Korn's 5th festival with admiration and good wishes.

ELECTRIC LIGHTING OF ODESSA HARBOR.

The Odessa Harbor electric lighting plant, constructed by the Thomson-Houston International Electric Company, was taken over on July 8 by the Russian Government, says the *Electric Engineer*. There are in regular working sixty-four 2,000 c. p. arc lamps and eight 125 c. p. incandescent lamps. The arc lamp-posts vary in height from 43 feet to 30 feet. There have been used about 10 miles of armored cable, manufactured by Felten and Guilleaume, and also about 1,000 yards of submarine cable 126 sq. mm. in cross-section, steel-wire armored. Where the submarine cable joins the land cable a Thomson-Rice cut-out is placed, allowing the cutting out of the submarine cable in case of fault. The generating plant consists of four 35-light series-wound arc dynamos, driven by belting from two central-valve condensing Willans & Robinson high-speed engines. The two boilers are supplied by the Babcock & Wilcox Company.

A STATIONARY ENGINEER LIVED TWENTY-NINE YEARS WITH A BULLET IN HIS BRAIN.

Charles C. Barowsky, who was a stationary engineer in Sioux City, Iowa, for twenty years, died there on Friday of last week. His fatal malady was inflammation of the bowels. A most remarkable thing about him is that he carried a bullet in his brain ever since the war. Twenty-nine years ago, while in the army, he received a pistol wound in the left side of the mouth, and since then has suffered intense pain in the head when laying on his right side or when stooping over. Before his death he requested that a post-mortem examination be held to ascertain the location of the bullet. This was done last Sunday. It was traced from the mouth upward through the orb of the left eye and then down and back through the vital part of the brain, where it was found encysted in a membraneous sack in the posterior horn of the left lateral ventricle. The portions of the brain through which the ball passed are the most vital. The physicians who examined him declare it a case unparalleled. Many cases are recorded where foreign substances have lodged in the upper portion of the brain, but they know of none like this.

The American Engineer.

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TO WHOM IT MAY CONCERN.

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JEFFERSON YOUNG, JR.
Supreme Chief Engineer A. O. of S. E.

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CONTENTS OF THIS NUMBER.

ATTENTION!

A notable change has been effected in the management of this journal—a change that is bound to enhance its usefulness and increase its prosperity. A list of the new officials appears above, and from which it may be seen that THE AMERICAN ENGINEER is now not only the official organ of the American Order of Steam Engineers, but is under the management of Supreme Chief Engineer Jefferson Young, Jr., who is also Secretary of the re-organized company,

CIVIL engineering has become too broad and indefinite to be used as a title for a professorship at the University of Wisconsin, as appears from their circular of information, extracts from which appear elsewhere. To drop the chair of civil engineering, "because, in the progress of engineering science, the title has become too broad and indefinite," is a hard blow on those who call themselves "civil engineers." Some of them may "kick," perhaps; but they will find it hard kicking against the pricks of progress.

THEORETICALLY the article in *Engineering News*, abstracts of which appear in this issue, is very conclusive as to the absolute necessity of professional training to develop a really good engineer. And no doubt that is the only way to become a merely professional engineer. Such a man would make a most ridiculous engineer without training. As in connection with many other things, fact does not coincide with theory in this case. Edison was only two short months in school in all his life. Faraday, before him, turned philosopher and electrician without professional training. Professional education is not to be despised by any means. But unusually great talents do not develop that way. And it is simply matter of history that when great inventions are perfected the inventors' experience has been in lines different to what the inventions pertain to.

MECHANICS AND ENGINEERING AT THE UNIVERSITY OF WISCONSIN.

A circular of information relative to the college of mechanics and engineering, shows that the managers of the University of Wisconsin have made a new departure.

By the reorganization the professorship of mechanical engineering becomes centralized upon steam engineering as its leading subject. The theoretical and scientific treatment of electricity and magnetism, heretofore falling under the professorship of physics, has been developed into a professorship of electricity and magnetism in connection with mathematical physics, and will have for its functions the fundamental scientific treatment of those subjects, while the practical side will be treated by an experienced expert under the professorship of electrical engineering. A professorship of bridge and hydraulic engineering has been developed from the chair of civil engineering and the latter title dropped, because, in the progress of engineering science, it has become too broad and indefinite. The assistant professorship of pure and applied mechanics has been advanced into a full professorship with the slightly modified title of theoretical and applied mechanics. The chair of mechanical practice undergoes no change except an enlargement of facilities. An instructorship in engineering has been added.

These important enlargements and readjustments have been made possible by the passage of the Morrill Act by Congress making a generous appropriation for the specific purpose of instruction in these departments, together with agriculture. This act has also enabled them to add very largely during the past year to the apparatus necessary for the most efficient instruction. This added to the previous excellent outfit renders the appliances of the College of Mechanics among the best in the country.

The importance of combining practical applications with theoretical studies is one of the controlling ideas which have induced those having control of this college to reorganize it, as above stated, on the belief that thorough-going fundamental training is the first essential to a successful engineer, but that this fundamental training may be best secured in connection with a certain amount of study of the practical applications of the principles involved, and not solely by theoretical study. It is further a leading thought that after the fundamental principles have been mastered a certain measure of specialization in the leading lines of engineering is advisable, because of the great development of engineering in recent years and the varied phases which it is rapidly assuming. The day is past when an engineer can be masterful in all departments, and hence an institution may not now content itself with a single general course. It is the endeavor of this institution to combine a prudent amount of specialization in the closing year with a thorough grounding in the fundamentals in the earlier portion of its courses; and in carrying this out, it endeavors to make its mathematical and theoretical courses strong in the earlier years, and its applied courses strong in the later years, while its draughting and shop courses continue progressively from the beginning to the end. It also introduces sufficient foreign language to enable its graduates to read the professional German and French literature and also to give so much of the mastery of the English language as to enable its graduates to present professional subjects with ease, clearness and effectiveness.

MUCH IN LITTLE.

A famous author has said that the whole career of the First Napoleon, a subject that has filled many volumes, could be all summed up in one sentence. However that may be, the Chicago *Graphic* has concentrated the contents of many volumes of history in the following brief article—multum in parvo:

The beginning of Balmaceda was in the mind of Napoleon.

The Emperor dreamed Alexandrean dreams of an universal empire; he dreamed that the French flag fluttered on the peaks of the Andes; that a new France ruled Argentina, England shattered this foolhappy dream of Napoleonic dominion. There was to be neither French nor Spanish dominion in the southland of the new world; so John Bull said. Young Brother Jonathan in later years picked up this cry—took it from Canning's lips—and made of it the "Monroe doctrine." A very potent doctrine which England afterward regretted begetting.

During this stress of affairs—while Spaniards and French and Indians were squabbling in Argentina—England sent over to that land two troops of unbreeched, hard-fighting, muckle-praying Scotchmen.

They fought and were defeated; were made prisoners and sent up-country. They broke through the guard-lines and scaled the Andes peaks and settled in a strange, white land called Tchile—Snowland.

There they found a grim, hardy set of bronzed men and women, who had been ever free. These were the Araucanians whom the Incas ruled and whom the Spaniards failed to subdue. The storm of the conquest broke—but passed them by. The French came and fired shotted guns, and English blue-jackets made a mighty noise in the low-countries, but up in the white hills of the Andes the Araucanians fought and laughed and were as free as the winds that come eastward over the great ocean.

Among these people the muckle-praying Scotchmen found wives and—not forgetting the biblical injunction—multiplied exceedingly; begot children, and many children. And when the Tchile, the old Snowland, became Chile, with government and officials and taxes and ministers to this country and that, these half-Indian Scotchmen became of much importance. They mixed with the Spanish, but the old blood still held good. It filtered down through two generations to this harlequin hero—Don Jose Manuel Balmaceda.

ADVICE TO YOUNG ELECTRICIANS.

"I will be much obliged to you if you will please give me information about electrical education for a young man eighteen years of age?"

Such is a sample of inquiries addressed to *Practical Electricity*, it says. And as the editor thereof (Dr. Austin) is not a practical man (in the ordinary sense of the term) he very wisely asked some of those eminent electricians who are practical, if they would furnish their "best thoughts" for the benefit of young men seeking advancement in the electrical business. The responses were most generous and hearty, it is said. And as thousands of our readers would like to read, mark, learn and inwardly digest some of those best thoughts, we avail ourselves of the opportunity of reproducing the following from our contemporary:

WHAT PROFS. THOMSON AND ANTHONY SAY.

"In general, a young man seeking advancement in any business—and the electrical business is no exception—must be prepared to work for that advancement. He should begin early in requiring the necessary amount of information, and the earlier he comes to a decision as to the work he will take up in after life, the better it will be. In this he should not be guided by the apparent attractiveness of the business so much as by his own tastes and inclinations. He should not follow caprice, but rather follow his natural abilities and prospects of making a success. Each young man in these respects is a law unto himself, and it is impossible to lay down a general rule which would lead to success. The ability to acquire information readily, to formulate one's ideas clearly, to retain information which has been acquired, and to act energetically yet cautiously in applying the acquired knowledge

has as much to do, perhaps, with his success as anything else.

"A young man to succeed in the electrical business, as in other business, must be prepared to undergo hard work, and he must unquestionably possess ability for the particular business. I would recommend that no opportunity to acquire a school education should be missed; but, wherever it is possible, the student should take such courses in the scientific and technical institutes as will prepare a ground work for practical work afterwards. We should seek to become practically familiar with machines, tools, etc., rather than to follow mere book descriptions. One word of caution may be added, that is,—he must not mistake a factory for a school. In the former, he is thrown very largely upon his own resources, and his success depends upon his own aptitude and effort. In the latter, it is the purpose to give him all the attention and assistance which he may need. In practical life, however, he must learn to rely largely upon himself.

"Elihu Thomson,

"Lynn, Mass."

"The advise that I should give in general to young men who feel that they have the ability to take a position of some responsibility in the electrical engineering profession, would be to first of all attend a regular course in electrical engineering in some of the technical schools. There are now several such schools in the country, where thorough scientific education may be obtained accompanied by practical work and experimenting as far as such can be obtained in an institute of learning. Cornell University, at Ithica, N. Y., is one of the best of these institutions, and has a very large equipment in the way of apparatus, instruments, electrical machines, and motors,—which are available for study and practical work by the student. The Mass. Institute of Technology, in Boston, the Stevens Institute of Technology, at Hoboken, the College of N. J., at Princeton, N. J., and Columbia College, in New York City, also offer courses in electrical engineering, and are well equipped for giving practical instruction. The course in any of these institutions covers four years of study and practice. Many young men look upon this as a long time to wait before going into their profession, but they will find that the time has been well spent, that their advancement in their professions after they have graduated from the technical school will be much more rapid and will reach a much higher plane than would be possible without such an education. It is only rare geniuses who will attain to any great eminence without having some such drill in the scientific principles, and it is only the rare student who would acquire the scientific knowledge if left to his own resources and obliged to make his own way. The young man must not make the mistake of supposing that when he graduates from the technical school he knows it all, and is prepared to take charge of work in the position of greatest responsibility. He must understand that the education that he has received is only the basis of the practical education that he must get by actual experience in active work outside, and he should be content to take a position low down in the scale and work his way up to the place which his talent and knowledge will certainly enable him to reach.

"Wm. A. Anthony,

"Manchester, Conn."

"ME AND MAMMA ARE THE ENGINEERS."

We have very favorable reports from Minerva Council, No. 1, Callfornia. And Corresponding Engineer Sidney Peard has sent us the following clipping from a local paper which shows that the authorities in San Francisco are waking up to the necessity of having real engineers in chargo of steam generators and engines:

A FEMALE ENGINEER WHO WAS NOT WELL POSTED.

At the meeting of the Fire Department Committee yesterday Louis Helbing asked that he might be allowed to continue maintaining a steam engine and boiler at 2 Hayward street. He insisted that the machinery was perfectly safe and that he had it under the charge of a competent engineer.

"I don't agree to that last proposition," said chief Scannell. "This is the man who has his wife and daughter run his engine."

"That is'nt true," said Helbing. "I don't know how that story started."

"I do," said the Chief. "It started because one of my engineers went out there and found a fifteen year old girl running the engine. He asked her where the engineer was and she said,'

"'Me and mamma are the engineers.'"

"Then he asked her what she would do if the boiler got empty.

"'Turn the cold water in,' she said.

"That would blow up the whole neighborhood.'

"'Have you got a safety valve?' he asked next.

"'I don't know,' she said. 'I guess so, for I think I heard it whistle once.'

"That, gentlemen, is the way this establishment is run."

The privilege was denied.

A TUNNEL NOW MAKES THE UNITED STATES AND CANADA ONE.

The opening of the St. Clair River Tunnel, between Port Huron in Michigan and Sarnia in Canada, last Saturday brings interesting reminiscences to mind, and opens a door for imagination to make calculations for the future.

The "underground railway" by which many negroes escaped into Canada, was formed by boats. If such a tunnel as that just opened and dedicated had been in existence in slavery days, Uncle Tom's Cabin might have been written quite differently in many respects. And the absence of such a tunnel, at this very place too—between Port Huron and Sarnia—was the occasion of demonstrating the clever wit and ingenious mind of one of the greatest scientists in the world to-day. To tell the story briefly: A telegraph operator of acknowledged ability (at the time), but unable to obtain a situation—because he was so clever and such a great experimenter, that people who could give him employment were afraid or jealous of him—was on the road "looking for a job." He happened to be in Port Huron when the telegraph wires between that city and the Canadian side were broken. They were in a great fix, and wanted to communicate with Sarnia very badly. But they were helpless. The young man "looking for a job" said that he could communicate with Sarnia! They thought he was Old Nick himself, if not a crazy man, if he could communicate with Sarnia, when the wires were broken. But Edison—for it was him—jumped on the engine, and pulling the whistle lever called out, in the language of the telegraph (giving short and long sounds, by the whistle, instead of dots and dashes), "Sarnia, do you hear me!" This was repeated, but there was no response for some time. At last the ear of a telegraph operator, across the river, caught the sound "Sarnia, do you hear me?" and at once jumped on the nearest engine, and whistled back, "I hear you." Thus they corresponded, and readily exchanged messages.

If Edison had not happened to be there at that time there would have been no communication between Port Huron and Sarnia until boats would have crossed. The new tunnel brings the two cities into still closer relationship. And it will be a great convenience to those traveling by rail in and between the United States and Canada. Not only that, but as remarked by all the speakers at the opening ceremonies, this tunnel is destined to be an important factor in cementing the bond of unity and friendship between the two countries.

A tunnel between England and France has been repeatedly "projected" during several decades past. But the English are afraid to give the French such a convenient access to their "tight little island." And more than that, in case the French and Britishers should ever learn to "love thy neighbor as thyself" so much as to remove the barrier of suspicion and prejudice which precludes the chance of the building of such an international tunnel, the newly-whiskered Emperor William would very likely object to such a close union between England and France as strongly as Lord Salisbury objects to the opening of the Dardanellos for Russian war ships. But the opening of the Port Huron (or St. Clair) tunnel is the cause of great rejoicing between those immediately interested—the Americans and the Canadians—and all the world looks on complaisantly. Victoria and the rulers of her Queendom may not like to see Canada becoming so much attached to Brother Jonathan. But they bear it and grin, and will probably submit to the unavoidable as graciously as circumstances may admit when the United States and Canada become one.

A Wonderful Engineering Achievement.

We have received the following description and history of the new tunnel:—

The St. Clair tunnel, on the Grand Trunk railway of Canada, extending under the St. Clair River between Sarnia, Ont., and Port Huron, Mich., is one of the most remarkable engineering feats of the present day. The Grand Trunk railway extended its lines to Chicago in 1880. About 5,000 miles of railway will use this tunnel. Previously steam ferries had been used. Their service has not been altogether satisfactory because the river's current is very swift; in winter there have been ice jams; the railway had to deviate about six miles; a bridge was impossible, owing to the nature of the ground and the opposition of the marine interests. The St. Clair River bears the most commerce of any stream in the world.

In 1884 preliminary surveys were made. Borings found the rock eighty-six feet below the level of the water; the river's greatest depth 40,47 feet and its width nearly half a mile. The strata were yellow sand about two feet; with sand and blue clay mixed about twelve feet, thence to the rock about twenty-one feet of blue clay. Plans and drawings were made. The St. Clair Tunnel company was organized in 1886. At first the company thought of starting from immense shafts on the shore, and then working outward to the land approaches. In 1886 test shafts were sunk on each side of the St. Clair River; drifts at right angles were started under the river; water and gas stopped work. In 1887 these shafts were abandoned, and in 1888 large shafts were begun. The American one will be used as a ventilator.

The tunnel plants were erected back from the river; in Michigan about 1,800 feet, in Ontario about 1,900 feet. Each plant contained a boiler-house, hoisting or winding engines, a ventilating engine, an air-blower with a capacity of 10,000 cubic feet of air per minute, a hydraulic pump for operating the rams, a machine shop with machines for tunnel work, a water pump for the pit, and an electric light plant. The tunnel will be lighted by electricity. The electric plant is in Sarnia, where permanent brick boiler and engine rooms have been erected.

The great cuttings for the approaches were commenced New Year's, 1889. Each cutting was made about sixty feet deep at the portal. The Canadian cutting at its broadest portion is 260 feet wide, the American about 200 feet wide. Into each pit inclined tracks were laid for engines to haul out the dirt. On the banks derricks were erected for hoisting the soil. In September, 1890, steam shovels began work on the cuttings. On each side of the river two shovels were used, each attended by an engine and train of flat cars. Several hundred men were employed night and day, lime lights being used at night, and the soil was removed in layers. The work of these shovels was greatly hindered by rains, and numerous landslides occurred.

The Hydraulic Mining Shields.

Because of water and quicksand the St. Clair tunnel could not have been constructed without the aid of hydraulic mining shields. Such shields have been used successfuly in London, Chicago, Buffalo, Broadway tunnel, New York City, the Hudson River tunnel, and in other works. This shield is a cylinder, like a headless barrel. Its front end has sharpened edges to cut into the earth. The thin rear end is called the hood. The inside is braced with iron, both vertical and horizontal. Around the main walls are sets of hydraulic jacks. Each jack has a valve whereby it may be cut off at any time from the pump that supplies all the jacks. The masonry, or iron plates, of the tunnel, being built up within the thin hood of the shield, air is supplied to the jacks and the shield is forced ahead, usually the length of the pistons of the jacks, or about two feet. The shield having advanced the men remove the soil from the front of the shield. Everything being in readiness the shield is again pushed forward, the tunnel walls built up, and the excavated soil removed.

Each of the St. Clair tunnel shields weighed

eighty tons. They were made of steel, manufactured at Hamilton, and erected on a bank of a cutting. Each shield was circular, having an outside diameter of 21 feet and 6 inches, its length was 15 feet, and its thickness 1 inch. The shields were lighted by electricity. When erected the shields were rolled on wooden tracks into the cuttings. Each shield has two dozen hydraulic rams, operated by two men. The air pump might have exerted 3,000 tons pressure upon the shield, but the greatest pressure used was 1,700 pounds per square inch, 40 tons per ram and 960 tons on the shield. Each morning the direction of the shield was taken. By the pressure of the hydraulic rams the direction of the shields could be absolutely governed. How well is shown by the fact that when the shields met, after traveling 6,000 feet, they were exactly together.

The American shield was started July 11, 1889, the Canadian Sept. 21, 1889, and they met at 11:30 p.m. Aug. 30, 1890. The shields' shells were left in the tunnel and the tunnel walls laid up in them. The American had done the most work, and the easiest progress was towards Canada, the average being ten feet each day. The greatest advance in a day was 27 feet 10 inches. The time spent was less than in any similar tunnel construction. The American shield, in fourteen months, bored 3,313.85 feet; the Canadian, 2,686.10 feet. Sunday afternoon, Aug. 24, 1890, the two gangs of workmen talked and exchanged presents through the auger hole bored between the two shields. The first man through was Chief Engineer Hobson, followed by other officials, and then the whole working force. Three gangs of seventy-five men were employed in three shifts, each of eight hours.

At first long, thin spades were used to remove the clay. A workman whose trade was coopering took an old saw, bent it like a horseshoe, and made a knife with which he could do three men's work. His knife was then used as a model tool for cutting the clay. Two men, grasping the two handles, sliced out slabs of blue clay a yard long, and easily kept ahead of the layers of the tunnel lining. The clay was loaded upon flat-cars by men. Mules or horses drew the clay-loaded cars out of the tunnel upon a tramway, on one of whose tracks the cars returned by their own gravity. The bed of this tramway was the blue clay, about two feet deep. When the tunnel was completed the removal of this clay bed consumed two months' time. At the tunnel entrance the clay cars were hoisted to the banks and dumped upon large railway flat-cars, by which the soil was removed and used in grading the new freight-yards, where about twenty miles of sidetracks were laid on each side of the river.

The tunnel walls are made of cast iron, suggested by Chief Engineer Hobson. In the circle are thirteen segments and a key. Each segment is 4 feet 10 inches long, 18 inches wide, and 2 inches thick, with flanges inside of $1\frac{3}{4}$ inches thick and 6 inches deep. In each segment were cast 32 holes, 4 in each end flange and 12 in each side flange. Through these holes passed steel bolts seven-eighths of an inch in diameter. In each section of the tunnel the circular joints required 157 bolts and the longitudinal joints required 56 bolts. The flanges took in a circle of 20 feet and 5 inches in diameter. The edges of the plates were planed in the machine shops near the tunnel entrances. Each plate was then heated and dipped in cold tar. This had been found better than to dip the cold iron into hot tar. Formerly the tar would not dry quick enough; later the tar was dried by the time the segments were cool. The segments were lifted to place by a circular crane revolving on a spindle in the center of the shield. This spindle had a vise at one end and a counterbalance weight at the other.

Effects of Compressed Air.

When the bed of the river was reached, quicksand and water made great trouble. For some time it was thought the tunnel might have to be abandoned. Compressed air was found a sure remedy. At the river line on each side, brick and cement, air-tight bulkheads were built across the tunnel. Each bulkhead had two air chambers, one on each side, 7 feet in diameter and 17 feet long, with air-tight doors at each end. Through each air chamber passed a car track. Inside the tunnel, beyond the bulkhead, work was begun under air pressure of 10 pounds to the square inch. From time to time the air pressure was gradually increased, until the men worked under an artifical pressure of 22 pounds per square inch, a total atmospheric pressure of 37 pounds per square inch, or about $2\frac{1}{2}$ atmospheres. On the Canadian side the highest air pressure was used because of quicksand. On the American side compressed air was used from April 7, 1890; on the Canadian, May 20, 1890.

The compressed air was shut off Oct. 7, 1890. It kept back the quicksand and water. Horses could not stand it and mules had to draw the cars. The men had to be examined by the company's physician and were required to have strong constitutions. Several deaths resulted from using the compressed air. About five minutes were needed to increase or diminish the pressure on the men passing through the air locks. A gang of men, or a car, would be admitted to the air chamber, the iron door closed, the air valve opened into the chamber, and the pressure regulated to that of the section inside or outside. Then the other doors could be opened without difficulty. Unless great care was used the men were attacked with the "benders," the symptoms being bleeding at the nose, mouth, and ears, and knees wabbling. Two ventilating tubes, each twenty inches in diameter, supplied pure air to the tunnel.

The tunnel walls are dry and look like a ship's ribs. Pipes and wires are swung overhead. Safety platforms and ladders have been erected for the tunnel workmen and inspectors. Long lines of incandescent electric lights glimmer as far as can be seen. Brick and concrete walls were built in the lower third of the tunnel to prevent the brine from meat cars leaking on them and rusting. The brick work was plastered over. Nearly a million of steel bolts were tightened up and creosoted pine timbers were laid in the bottom of the tunnel. Beneath them are the three spaces for drainage, while above them is the railway track of standard gauge—4 feet $8\frac{1}{2}$ inches. Extra heavy steel rails, 100 pounds to the yard, are used. The tunnel will drain itself into a pump shaft on the Canadian side. This shaft is 112 feet deep, 15 feet in diameter, and down to the rock. The water does not flow more than fifteen gallons per minute in the entire 6,000 feet of the tunnel. Rain and surface water is caught at the portals and pumped out.

The tunnel approaches have the same general appearance of solidity as the tunnel itself. On each side of the great cuttings are high and deep stone retaining walls. Each portal is 36 feet high and 148 feet wide, about 10 feet thick over the entrance of the tunnel, and about half that width at each end. Like the retaining walls the portals are made of rough, heavy limestone blocks. Over the entrance of each portal is inscribed "St. Clair, 1890." The diameter of the circle is 20 feet, and flush with the tunnel.

The average number of men employed was 700. In the tunnel eight hours made a day's work. The tunnel was estimated to cost $3,500,000 including plants, materials, and labor, and it required about that sum. It is likely that a second tunnel will be built near this. The present plants and experience will then be of additional value. The second tunnel will be of cast iron, as it is superior to brick and cement for similar tunnels.

Dimensions, Etc., of the Tunnel.

The St. Clair tunnel is 6,000 feet long. To the river's edge on the American side it is 1,716 feet; on the Canadian, 1,994 feet; under the river, 2,290 feet. The outside diameter of the tunnel is 21 feet, the inside 19 feet 10 inches. The tunnel nearest the river is 8.43 feet from the river. At its lowest point the top of the tunnel is 56.83 feet below the level of the river. From each portal to the river the grade is 1 foot down for every 50 feet; under the river, 1 foot down in every 1,000 feet toward the Canadian side to that drainage shaft. Over 2,000,000 cubic feet of soil were taken from the tunnel itself. The cast-iron lining of the tunnel weighed 54,000,000 pounds. To fasten this lining 828,150 steel bolts seven-eights of an inch in diameter were used. The Canadian open cutting is 3,193 feet long; the American, 2,532 feet long. The total length of the tunnel and its approaches is 11,725 feet.

The best kind of locomotive for this tunnel's use was discussed for some time. Coke engines were finally adopted. Three were built at the Grand Trunk shops of the "consolidated" pattern. Each engine can draw twenty-five loaded cars. One engine will be reserved for any possible accident, and one engine will be used on each side of the river. The car ferries will be discontinued.

In Port Huron Aug. 20, 1890, was recorded one of the largest mortgages ever given in Michigan. It was for $2,500,000. The St. Clair Tunnel company gave it to secure bonds running fifty years and bearing 5 per cent annual interest, covering all the present property of the company. Rent and tolls can be collected for allowing other railways than the Grand Trunk system to use the tunnel.

Joseph Hobson, chief engineer of the company and builder of the tunnel, was born in Canada. From 1870 he was for three years the resident engineer of the International bridge at Buffalo over the Niagara River. Since 1875 he has been a chief engineer of the Great Western railway of Canada and of the Grand Trunk railway of Canada. In the St. Clair Tunnel works his able assistants have been: First assistant engineer in charge, Thomas E. Hillman; second assistant engineer, M. S. Blaiklock; mechanical superintendent, J. T. Eames; superintendent of excavation, Thomas J. Murphy.

It is believed that the Grand Trunk route, as thus improved will offer facilities for through communication between Chicago and all points in the East which will be appreciated by passengers and shippers. There will be no more trouble from ice blocks or other obstruction in the river and the best time will be made for traffic of all kinds.

AN ENGLISH BOILER EXPLOSION.

Whenever our great London contemporary, *Engineering*, contains a boiler explosion report, we know it has something of interest to all our readers. The last issue to hand (that of Sept. 11) brings the news of a boiler explosion at West Bromwich, a thickly populated section of the famous "black country," and situated about six miles north by north-west from Birmingham. The enquiry into the cause of the explosion in question is one of three "formal investigations" recently held. The explosion of West Bromwich occurred on Friday, July 17, at the iron foundry of Cross & Son. The boiler was of the plain cylindrical, egg-ended, externally-fired type, measuring 30 ft. in length over all, by 4 ft. 8 in. in diameter, and was made of plates originally $^{15}/_{32}$ in. thick. The blowing-off pressure was stated to be 40 lb., but it was really 52 lb., the gauge being defective to the extent of 12 lb. The boiler was about 25 years old, and very extensive repairs had been made over the fire from time to time.

The shell rent through the line of rivets at a longitudinal seam in the third and fourth belt of plating over the fire near to the bottom on the right-hand side. The rent extended at both ends in an oblique direction right round the shell, which was torn into three portions. These were blown in different directions, while the debris was scattered over an area embraced by a circle having a radius of about a quarter of a mile, several houses being partially wrecked by invading fragments. Three persons were killed and five others injured, and it is surprising, considering the thickly populated character of the district, that the fatality was not greater.

The explosion was due to a seam rip at the before-mentioned longitudinal seam where repairs had been effected, and where the iron was short and brittle. The rip was probably caused by the inferior quality of the iron, coupled with the punishment received in making the repairs.

Former evidence was given in support of the foregoing facts as reported in *Engineering*. The "engineer's" name is John Harris, who said he was an engine driver, and had been employed by Messrs. Cross for four years. He had not served his time in the shops as a fitter, he said. When he examined the boiler he looked to see if there were any cracks in the plates or any leakages. He had received no instructions from Messrs. Cross as to examining the boiler, but he used to examine it. He fixed the pressure gauge himself with a syphon.

As Commissioner Smith said, "Harris was more of a boiler minder than an examiner."

Two professional witnesses testified as to the immediate cause of the explosion. Consulting Engi-

neer E. B. Marten said that the boiler had become so weak that the ordinary working pressure was sufficient to cause it to explode. He attributed the explosion to the bad quality of the plate which first gave way.

Engineer-Surveyor Robt. Watt attributed the explosion to corrosion and seam rip. The plates where the brickwork had covered them were reduced by external corrosion, he said. He did not approve of the quality of iron in any part of the boiler.

The verdict of the court was that "the explosion was caused by the inferior iron of which the boiler was made, and the corrosion, which rendered the boiler unable to stand the pressure put upon it."

Engineering points out, however, that "the corrosion to which reference was made by the engineer-surveyor to the Board of Trade and the presiding Commissioner did not affect the safety of the boiler inasmuch as the plate which failed was fully ⅝ in. thick. Some stress was also laid on the fact that there was a discrepancy of 12 lb. in the pressure gauge. In considering the bursting pressure of a boiler, however, 12 lb. more or less is practically of little consequence, and it is better not to confuse the main question with side issues and unimportant details."

The owners of the boiler were let off on payment of 25 *l.* each toward the cost of the investigation. They said the explosion had caused them a loss of 1,000 *l.*

CORRESPONDENCE.

HEADQUARTERS
SUPREME CHIEF ENGINEER.
PONTIAC BUILDING,
CHICAGO, ILL., Sept. 23, 1891.

To the Officers and Members of the A. O. of S. E.

BRETHREN:—You are hereby notified that I have moved the headquarters of our Order to Chicago. All mail should hereafter be addressed to Room 1301, Pontiac Building. I remain

Yours Fraternally,
JEFFERSON YOUNG, JR., S. C. E.

The Ohio A. O. S. E. "Baby."

To the Editor of the American Engineer:

SIR:—At the last meeting of the Queen City Council, A. O. S. E., there was quite a lively time for there was a double duty for the council to perform. After the regular order of business was gone through, the Grand Chief, Bro. F. S. Neal, of Queen City, asked permission to use the hall for the purpose of starting Eagle Council No. 7 in motion, by putting the boys through the regular form, which was unanimously accorded, and the boys of Queen City volunteered to assist in the ceremony, which passed off in good style, and No. 7 was launched out in the mysteries of the noble Order of A. O. of S. E. with a goodly number of the best engineers of the City of Cincinnati.

The following is the list of officers:
Chief, Jas. Band.
First Assistant, L. Maratta,
Chaplain, N. Bennett.
Rec. Engineer, J. Pepper.
Cor. Engineer, R. Carry.
Treas. Engineer, R. Lyon.
Fin. Engineer, J. Hilton.
S. M. M., T. Hinson.
J. M. M., J. Heisel.

After all were duly installed they held a short session to get their hand in, so as to handle the "machine" properly, which they did with credit to the baby of Ohio, owing to the care and watchfulness of G. C. Neal. At the end of the session a unanimous vote of thanks was tendered No. 3 for courtesies shown; and then all adjourned well pleased.

CORRESPONDENT.

St. Joseph Council No. 2, Mo.

To the Editor of the American Engineer:

SIR:—St. Joseph Council No. 2, was organized Sept. 8th and elected the following officers: Chief Eng., W. A. Sullivan; F. A. Eng., Frank Blum; Rec. Eng., Chas. Wilson; Treas. Eng., John R. Etchison; Fin. Eng., Jas. W. Prashak; Sr. M. M., Jake Fletcher; Jr. M. M., C. E. Chamberlain and James Foley, inside and outside Sentinel. Our Council meets every second and fourth Tuesdays at Brokaw's Hall, cor. 8th and Locust streets.

FRANK BLUM, Cor. Eng.

Corliss and Slide Valve Engines.

To the Editor of the American Engineer:

SIR:—I have been an interested reader of the controversy between "Old Slide Valve" and his associates and the Corliss men, and have expected to derive some benefit from it. But I must say that I have not.

It seems to me that the controversy has developed into a little boys' blowing match. "You dasen't knock this chip off my shoulder," says one, and "you dasen't pull the leaf out of my hat," says the other.

And talk about figures and cards! I don't believe that either party could figure out the M. E. P. of a card, unassisted, to save their jobs. If they can, why don't they do so?

And one thing that disgusts me more than anything else is, to have one say "now I will answer his question by asking another," and then go off on a rambling statement that does not bear on the subject at all. For instance, "Old Reliable" remarking that as Bro. Corliss had gone to sea, he would answer him by asking a question; and, for the life of me, I can find no question in all the rest of his letter. But he goes on with a statement about the respective engines in the several steamers of the Cunard and Collins lines. And then he tries to make himself, and us, believe that, because the Cunarders have had slide valves, the line is in existence to-day; while if they had had poppet valves like the Collins line of steamers, they would have all been lost at sea. Fudge and nonsense!

Has "Old Reliable" ever heard of a steamship being lost on account of her valve giving out? *That is one question,* and here is another. Does "Old Reliable" consider that the Arctic would not have collided with the French steamer if she had had slide valves that took four men and a pilot's wheel to handle? And does he for a moment think that the Pacific was lost because she had poppet valves that one man could easily handle? Ah! consistency, thou art a jewel!

I wonder if "Old Reliable" really thinks that they are still using the same old slide valves on the Cunard line steamers they used 50 years ago? And one thing more I would like to ask "Old Reliable" is if he knows *anything* about the valves of the modern ocean steamers, say "City of Paris" or "City of New York," would he kindly send a sketch or description of one to the next number of our valuable paper? And I think if he would inform himself a little better, he would find out that the Laclede Rolling mill shut down for good, for the same reason that over a hundred other mills shut down, because the business did not pay, and *not* because their engines gave them trouble.

Now, dear editor, prick those old wind bags, and if there is anything but chaff in them lets have it, if not give your space to more valuable matter.

Yours, with long suffering,
G. H. K.

Editor, American Engineer:—

SIR:—I have been very much interested in the controversy of the Corliss and slide valve engines, and I would say that if all "Old Slide Valve" says is true I am away off, and I would like to have a few points from him as to how to run a slide valve engine. I am running one now, and I have been trying to get my employer to take it out, and put a Corliss in its place, for I told him that he would save 40 per cent in coal by so doing; and I believe he will. And if "Old Slide Valve" is such a firm believer in the slide valve engine and knows any one in his vicinity that wants a good slide valve engine 11x30, in first-class condition, they can get it from my employer very cheap.

I should like to see a card from his engine, and also those figures that are going to knock the Corliss engine silly.

CORLISS ENGINE.

It is peculiar that the faster a man is the sooner age will overtake him.

REVISED CONSTITUTION OF THE SUPREME COUNCIL, AMERICAN ORDER OF STEAM ENGINEERS.

(*Continued.*)

City and State subordinate members, plain blue badge plain bar with name and number of council, city and state, A. O. of S. E. at top of ribbon.

ARTICLE XVII.

CONSTITUTION AND BY-LAWS.

OBLIGATORY.

All constitutional provisions contained in all articles, sections or paragraphs of this constitution and by-laws are obligatory in every sense on all grand and subordinate councils American Order Steam Engineers and all grand and subordinate council laws in contravention or conflict herewith are rendered void of effect and illegal in enforcement or if enforced are acts of contumacy, liable and subject to proper punishment.

ARTICLE XVIII.

WHEN IN FORCE.

All laws, enactments or legislation of the Supreme Council become of force from date of passage and publication.

ARTICLE XIX.

CERTIFICATES.

Subordinate councils shall issue certificates to their members. The grading of certificates shall be optional with the subordinate council issuing the same.

ARTICLE XX.

MUTUAL BENEFIT.

At the death or total disability of a member of the Order in good standing, every member of the Order shall be assessed as prescribed by the Supreme Council, and one dollar per member of the Order shall be paid to the widow or heir, a sum not exceeding $2,000.00.

In case of *total disability* a member shall receive a sum not exceeding $2,000.00. All over that amount received shall be placed in the fund for future deaths.

No assessment shall be made if there is enough money in fund to pay the benefit.

ARTICLE XXI.

COMMUNICATION.

All communications from Supreme, grand and subordinate councils must be on official letter-heads and enclosed in official envelopes selected by the Supreme Council.

ARTICLE XXII.

PUBLICATION, PRINTING, ETC.

SECTION 1. Supreme Council shall endorse a weekly paper known as the AMERICAN ENGINEER, an associate editor shall be elected by the Supreme Council. It shall be the official organ of the Order.

SEC. 2. The Supreme Council shall have printed all matter for the proper work of the Order as set forth in the by-laws.

SEC. 3. *All grand or subordinate councils are positively forbidden to print or have printed any of the secret work of the Order.*

ARTICLE XXIII.

SUPREME DELEGATES REPORTS.

Supreme delegates written reports to their grand councils, or to the subordinate councils under the immediate jurisdiction of the Supreme Council are official in so far as rendering a supreme law operator in its effect prior to the issuance of the journal of the proceedings or general orders are issued. When said general promulgation and issuance of the journal or orders if differing from their reports in letter, spirit or construction, it (journal or orders) must be immediately conformed to in every respect.

ARTICLE XXIV.

PASS WORD.

The supreme chief engineer shall have exclusive rights of creation and promulgation of all pass words, proper and fitting for the care involved—to rescind, call in and change the same if circumstances require it or the exigencies of the case warrant—prescribed their application and use.

ARTICLE XXV.

Annual Returns.

Each grand council under the control of the Supreme Council as also all subordinate councils in any state or territory where there is no grand council legally at work or properly instituted, shall make out annual returns of its work and business in accordance with the form sent or delivered to them by the supreme corresponding engineer, or other proper officer, and forward the same with the legal dues or tax from that body to the Supreme Council to the supreme treasurer engineer on or before the first of May of each year, a copy of the report must be forwarded to the supreme corresponding engineer, or in default thereof, such grand council shall forfeit its right to representation at the next Supreme Council.

ARTICLE XXVI.

Appeals and Writs of Error.

Section 1. All appeals and writs of error taken from the action or decision of a grand council or subordinate council under the immediate jurisdiction of the Supreme Council to the supreme chief engineer, but in all cases the action or decision of a grand or subordinate council under the immediate jurisdiction of the Supreme Council, shall be final and conclusive until reversed by the supreme chief engineer, and his action or decision shall be final until reversed by the Supreme Court of the Order, on appeals of prosecution of a writ of error therefrom as hereinafter provided.

Sec. 2. An appeal may be taken from the action or the decision of any subordinate council under the immediate jurisdiction of the Supreme Council to the supreme chief engineer by any member of such subordinate council, or by any other person whose rights have been denied by such action or decision upon giving notice to said subordinate council or said appeal within two weeks from and after such action or decision.

Sec. 3. With the consent of a grand council an appeal may be taken by any subordinate council or member under its jurisdiction from any action or decision of such grand council to the supreme chief engineer. Provided, however, that such consent shall not be necessary when a suspended or dissolved council after having surrendered to its grand council all its effects, books and property, appeals from such decision, and provided further that any such action or decision of a grand council where is drawn in question any provision of the constitution or any enactment or authority of the Supreme Council, and the action or decision is against the validity of such provision, enactment or authority, may be examined and reserved or affirmed by the supreme chief engineer upon a writ of error to the same extent as could have been done upon an appeal legally taken from such action or decision.

Sec. 4. Such writ of error as provided for by the last section may be issued by any upon petition to either the grand chief engineer or the grand council, the action or decision of which is sought to be removed, the supreme chief engineer or the Supreme Court of the Order in the case provided for in the foregoing, and in the order only as above named in this section.

Sec. 5. Consent of the grand council to appeal must be obtained at the same session at which the action or the decision from which such appeal is sought to be taken was had, and the proper record upon such appeal must be transmitted properly attested to the supreme chief engineer within sixty days thereafter. The same rules shall also apply in prosecution of a writ of error.

Sec. 6. All appeals or writs of error taken from the action or the decision of the supreme chief engineer by grand councils or officers thereof or by officers or members of subordinate councils under the immediate jurisdiction of the Supreme Council, must be submitted to the Supreme Court of the Order within sixty days after such decision has been rendered.

Sec. 7. The Supreme Council may also adopt such additional rules and regulations as may be deemed necessary and proper to fully carry into effect the foregoing provisions of the article.

ARTICLE XXVII.

Deputy Supreme Chief—Honors.

Any member to whom a commission as deputy supreme chief shall be issued in any state or territory where the Order is not already established or if so where no grand council exists, shall be entitled to and receive the rank of past chief engineer, and if in a territory where the Order exists, and a grand council is instituted while he is in charge thereof, he shall be entitled to and receive at the hands of this Supreme Council the rank and grade of past grand chief engineer, therefore, except as above or as otherwise provided in this constitution the grade or rank of past chief engineer shall not be conferred upon any past chief engineer who has not served as grand chief engineer.

ARTICLE XXVIII.

Deputy Supreme Chief Engineer.

All past grand or past chief engineers of full rank regularly authorized and commissioned by the supreme chief engineer to institute grand councils or to travel under his instructions to exemplify the work, shall be known, commissioned and styled deputy supreme chief engineer.

ARTICLE XXIX.

Expenses of Instituting.

The necessary expenses incident to traveling to any point and back to the original starting point for the purpose of instituting any subordinate or grand council by a deputy supreme chief engineer, shall be paid by the council instituted.

Grand or subordinate councils, instituted by the supreme chief engineer the expenses of the organizing shall be paid by the Supreme Council.

ARTICLE XXX.

Rank Credentials.

All members having passed rank removing from one jurisdiction to another and desiring to affiliate on a withdrawal card must also present a rank credential to entitle him to the same.

ARTICLE XXXI.

Ballot—Black Balls.

Grand councils may legislate in their local law to prescribe that *one black ball* may reject in case of application for membership, but shall not increase the same to more than as prescribed in the supreme maximum of two.

ARTICLE XXXII.

Seals.

All grand and subordinate councils shall have an appropriate seal, bearing proper devices thereon, name, number and location of the council, with the date of institution thereon, a good copy or impression of which shall be deposited with the supreme recording engineer.

ARTICLE XXXIII.

Compile Proceedings.

It shall be obligatory on all grand and subordinate councils of this Order to have full volumn of the Supreme Council proceedings and laws as issued, on hand for ready reference in law or usage points, and hereafter any and all new subordinate councils one full copy or set of Supreme Council proceedings shall constitute an indispensible part of their supplies, to be sent out and paid for. All sets of work, etc,, as herein enumerated shall constitute the legal numbers to be issued by any and all grand councils or officers which shall neither be added to nor taken from by them, and all work delivered to grand and subordinate councils or officers ordering the same, must be paid for on date of delivery, free of expense to the Supreme Council.

ARTICLE XXXIV.

Elections—Supreme Council.

The supreme chief engineer and supreme first assistant engineer shall be elected tri-annually, and all the other officers bi-annually, by ballot. A majority of all the votes present shall be necessary to constitute a choice. In case of a *tie* the balloting shall continue until a choice is made. The name of the brother receiving the lowest number of votes at each balloting shall be withdrawn. Any officer who may be absent at the time of installation, unless excused by the Supreme Council or by sickness, his office shall be declared vacant and another and immediate election held to fill the vacancy, but if the absent officer elect has been excused, or is ill, then the supreme chief engineer may be empowered to install during recess at his convenience.

ARTICLE XXXV.

Traveling Cards.

Traveling cards for the use of brethren can only be used or recognized when procured from the Supreme Council, and are of the prescribed and legal form as adopted and under its restrictions, made for general or special use by grand council and from them spread to the subordinate councils for issuance to members, except it be where no grand council exists, or recognized by the Supreme Council, and in such cases from the deputy supreme chief engineer in charge of said state.

ARTICLE XXXVI.

Regalia.

All supreme, grand or subordinate council officers appearing in the prescribed badge of the Order indicative of their rank and wearing the proper and prescribed official badge on the left breast—or

All past supreme, grand or subordinate council officers appearing wearing the proper prescribed past official badge on left breast—or

Any and all members appearing with a members' badge on the left breast, shall be considered in full and complete regalia for all council meetings or sessions proposed, being entitled to admission to and seat within any council of the Order, (if otherwise qualified and entitled to admission) wherever existing.

ARTICLE XXXVII.

Suspension of Council.

The Supreme and each grand council may provide for and order the revocation of any or all dispensations or charters and suspensions of subordinate councils under their jurisdiction for violations of this constitution, Supreme Council Order enactments, legislation or decisions or their grand council constitutional provisions, local laws, or grand chief engineer's official mandates during recess.

ARTICLE XXXVIII.

Terms.

A term of the Supreme Council shall be two years and the terms of subordinate councils working immediately under the control of the Supreme Council shall be one year and the term of subordinate council working under the control of grand councils shall be remitted to the several grand jurisdictions—*provided* that no term of the subordinate council shall be less than six months.

ARTICLE XXXIX.

Amendments.

No alterations or amendments to the Constitution of the Supreme Council shall be made unless presented at a regular session.

They must bear the seal of the grand council and the signature of the grand chief engineer of the state from which they emanate.

In states where no grand council exists they may be submitted through the deputy supreme chief engineer in charge. All amendments shall lay over for two years. Then if two-thirds of the Supreme Council shall vote in favor thereof it shall become a law—*Provided* that no change shall be made in the written or unwritten work unless the same lay over for one session. Nor then unless four-fifths of the delegates concur therein—*Provided always*, however, that the Supreme Council shall have the power to exercise a special prerogative to alter or amend any part or portion of the foregoing Constitution by unanimous consent—whenever the interests of the Order so demand.

(A true copy). Jefferson Young, Jr.,
S. C. Engr.

Chas. E. Jacks, S. R. Engr.

EAGLE COUNCIL NO. 7, OHIO.

Eagle Council No. 7, A. O. S. E., of Cincinnati, Ohio, was organized September 15, by Frank S. Neal, Grand Chief of Ohio, who then installed the members and officers. The names of chief and corresponding engineers are in the Directory, (p. VI.)

It has been calculated that the electro-motive force of a bolt of lightning is about 3,500,000 volts, the current about 14,000,000 amperes and the time to be about 1-20.000 part of a second. In such a bolt there is an energy of 2,450,000,000 watts, or 3,284,182 horse-power.

CONDITION OF WORKINGMEN IN MICHIGAN.

The following statement has been published in the *Scientific American*, and other contemporaries, and it is of special interest to the American Order of Steam Engineers.

The Bureau of Labor and Statistics of the State of Michigan has just completed a most interesting investigation. A personal canvass has been made of 8,838 workmen in 201 shops and manufacturing institutions in 25 villages and cities. The industries covered in the investigation were manufacturies of agricultural implements and iron-working establishments, and the information was obtained, not by sending out blanks nor by special canvassers but by the regular employes of the Bureau of Labor, who visited each workman in person and secured the facts desired. When it was necessary each question was fully explained to the person interrogated, in order to place him in a position to give an honest and intelligent answer.

In the industries canvassed the best of feeling is reported as existing between the workmen and proprietors. With the exception of the carpenters' strike in Detroit, there were no serious labor troubles in Michigan in 1890, and the good feeling now prevailing promises to continue.

Of the 8,838 employes, 57 per cent. were born in the United States and 43 per cent. in foreign countries. The total amonnt of earnings for the year was $4,127,591.20, average per man $467.02. The lowest annnal wages was $312.46, and the highest $653.54. The average weekly wages of married men is $11.50, single men $8.12, all employes in the canvass taken together, both married and single, $10.06 per week, or $1.67⅔ per day.

There is no "child" labor in the industries canvassed, bnt 235 boys are employed between 11 and 15 years of age. According to law, all boys under 14 years of age are prohibited from working more than 9 hours a day and must attend school 4 months in the year. The total family expenses for the year is given at $2,550,521. making per capita $122.48. Scotchmen, Englishmen, and Americans in the order named are the best livers, and have the highest per capita of family expenses. The Polanders and Germans spend the least money.

Two thousand three hundred and twenty-eight employes own homes, of which 2,242 are married men, the percentage of married men owning their own homes being 46. The Germans are the home-owning nationality. The percentage of those who own their house and lot is 37, Hollanders 35 per cent., Irishmen 33 per cent., Scotchmen 30 per cent., Polanders 28 per cent., Englishmen 25 per cent., Americans 22 per cent., and Canadians 18 per cent. The total value of homes is $3,055,965—which give an average valne for each home of $1,312.70.

One thousand three hundred and forty-two homes are mortgaged, which is 58 per cent. The total value of the mortgaged homes is $1,630,360, amount of mortgages $614,485, which is 37 per cent. of the valuation. In the towns and cities outside of Detroit the average age of those who own homes and have them paid for is 41 years.

The average weekly wages of those employes outside of Detroit who own homes upon which there is no incumbrance is $12.29.

During the year 1890, 1,390 employes made payments and improvements upon homes amounting to $175,470, and 2,477 saved $329,880 in money; 264 of the 1,390 who made payments and improvements on homes also saved money and are included in the 2,477 above stated. The total number of persons who saved something dnring the year, including payments and improvements upon homes and money, is 3,603, which is 40 per cent. of the total employes canvassed.

The total present worth of 7,474 employes (1,364 not reporting) is $3,461,164, average $950.98. Eighty-eight employes are reported to be worth over $5,000.

Two thousand one hundred and sixteen workmen carry life insurance, which is 23 per cent. of the total employes. In Battle Creek 51 per cent. of the lives of the workmen are insured, and the amount for which all the workmen canvassed are insured is $1,945,706; average $1,488.80. Two thonsand two hundred and forty-three, or 25 per cent. of total employes belong to benefit societies paying an average weekly sick benefit of $6.41.

One thousand and forty-six foreigners brought money with them when they came to the United States amounting to $176,354; average $168.57. Total present worth of foreigners, 3,293 reporting, $2,693,610; average $817.98. Total increase over the entire amount brought to this country, 1527 per cent.

Three thousand six hundred and twenty-seven persons own sewing machines, which is 69 per cent. of those who support families. One thousand eight hundred and seventy-five own musical instruments, which is 21 per cent. of total employes. Number of musical instruments owned, 2,046, of which 709 are organs, 314 pianos, and 299 violins.

There were found to be 5,949 persons who took newspapers and magazines, which is 67 per cent. of all the employes canvassed. In the city of Tecumseh 87 per cent. of the employes covered by the investigation take newspapers and magazines. The number of newspapers and magazines taken among the 8,838 workmen is 9,924, as follows: Dailies 5,103, or 51 per cent; story papers 443, or 4 per cent; magazines 343, or 3 per cent. Only about 5 per cent. of the workmen cannot read or write.

Among the questions asked the workmen by the representatives of the Labor Bureau was this: "Has your labor organization been of any financial benefit to you?" and only 1,212 persons were willing to reply to the question, 778. or 64 per cent. of these answering yes, and 334, or 35 per cent. saying no.

Two thousand four hundred and twenty-one men, or 25 per cent. work at hand work, and 5,816, or 65 per cent. at machine work, and 601, or 6 per cent. at both.

TRAINED AND EXPERIENCED ENGINEERS.

Every now and then some young man seeking a vocation in life asks us whether or not we would recommend a thorough training at a technical school as a necessary preliminary to entering some one of the many branches of engineering, says *Engineering News*, which goes on to say:

Many ingenious arguments are advanced in favor of combining study with practice in the field or work shop, and many names famous in the annals of engineering are quoted as belonging to men who have literally risen from the ranks, men like the elder Stephenson, Telford and Smeaton and the bulk of American civil engineers connected with the infancy of engineering in the United States. It is argued that study combined with experience is more efficient, and that facts gathered in practice teach more than dull books conned in a school-room.

In answer to the query above, we most emphatically recommend the most thorough scientific and general education at the best technical school available as an absolutely necessary preliminary step to successful practice in any branch of engineering. The time has passed for self-teaching, and Stephensons, Telfords and Smeatons are rare in this day. Some young men, by reason of natural qualifications, untiring labor and personal chance or opportunity, may succeed in spite of the lacking early technical training. But these same men would have advanced more rapidly and risen higher had they had the opportunities referred to. The modern science of engineering is too broad, its detail too intricate and its progress too rapid for the untrained mind to keep pace with it; and education in those who adopt engineering as a profession is so general and the schools are now so well equipped in teachers and apparatus, that even a phenomenally bright young man who starts out without these advantages will find himself sorely handicapped in the race for preferment. He may succeed, and some do succeed, but it is uphill work and a waste of useful energy.

Engineering is a many-sided profession, in the first place, and is utterly unlike its elder professional brothers in this respect. It enters in some of its many branches into our very life; it means modern progress in the world, and without it civilization would stop. Engineers—not divines, lawyers or doctors—are entitled practically to all the credit for the phenomenal material advance made in the civilized world in the last century, or even in the last half century, that spans an era of development far surpassing in its scientific achievements any equal period in the world's history. It is the engineer—civil, mechanical, hydraulic, sanitary mining or electrical—that has created our railways and canals, built our steamships and battle-ships, brings wholesome water to our doors, and sets thousands of spindles whirring by water power; drains, builds and paves our cities; improves the homes of rich and poor; turns our metals into finished products, and sets space and time at defiance, and lights our cities and carries their people by the power derived from the electrical current. In fact, it is hard to say what an engineer is not, or what he may not be called upon to do.

Under these conditions it is naturally very difficult for either the young man, or his parents, to decide which of the many distinct paths of engineering it is best for him to enter; in which one he would be most likely to succeed. It is just here that the technical school, as now organized, has its real value, as an indicator of the best course to pursue. It is true that some of these schools are intended to train men for special branches of engineering, civil, mechanical, electrical, etc.; but as a rule the earlier courses of these institutions have for their purpose the development of the natural endowments, and do this by a general course of scientific training that is common to all branches of the profession, and essential as a foundation for any special branch. The work shop, the laboratory and practice in the field now go hand in hand with theoretical teaching, and if the student has any natural inclination toward any special field of applied science, the fact is soon made evident to himself and to his teachers. With the direction once pointed out, it is then easy to find and follow to any end the path in life for which he is best fitted, and in which the student and the man is most likely to succeed. To-day there are schools for the advanced student in any one of the special branches of engineering that he may select, and the amount of knowledge gained before he commences to practice depends purely upon his own mental capacity and power for work.

But, say some young men, all this higher education costs money and we have not got it. Then our honest advice is, seek some other field of work where a technical training is not necessary. There are altogether too many self-taught engineers in the field now in this country and in every section of the United States evidence can be found of their honestly intended but faulty work. Any young man can enter an engineer corps, learn to drive stakes, pull a chain and run a level or transit in time. By force of circumstances, opportunity or personal influence among the controlling spirits of a corporation, he may finally succeed to a position of some responsibility, and he then usually assumes that he is a full fledged civil engineer. So he is as far as the duties we have first enumerated are concerned, and he may do all of these well. But this is not civil engineering; it is scarcely worthy of being called the A B C of the art. Telford defines engineering as "the art of directing the great sources of power in nature for the use and convenience of man." To realize this definition the engineer must be well trained, he must know what other engineers have done, be mentally equipped so that he can follow their line of reasoning, profit by their experience, and be enabled to think and to plan for himself. He must know many things and know them well, and to obtain this information the technical school, with its trained and experienced staff of teachers, its laboratories, its work shops and its facilities for experiment and original research is essential.

Engineering is a profession of emergencies; the unexpected thing is always turning up and the engineer must be ready to meet them, and to meet them at once. He is often so situated that the best library of reference obtainable with money is of no avail, for it is inaccessible when wanted and time to consult is lacking. Vast interests or human life may depend upon what work he performs within a few hours, and to perform this work he must first know what to do and how to do it. It may be that he meets a difficulty that is unique in its way, or, if it has happened to other engineers, the methods pursued are unrecorded. But if he is well grounded in the leading principles of his profession, has a broad grasp on the field of engineering knowledge, has gained wisdom by the emergency experience of other engineers, even in other fields, and above all is sure of himself, he will quickly devise some way out of the scrape and gain renown and advancement for himself—though this latter does not always follow in this selfish age.

The timid engineer, who has no capital but the scanty knowledge he has picked up in the intervals of a busy life, may attempt to do something under these circumstances of danger, and he may possess sufficient force of character to put his plans into execution. But he usually does the wrong thing, commences at the wrong end, puts his props in the wrong place and generally bungles. And when he has time to hunt up authorities he appropriates a formula without understanding its limitations or controlling conditions, and builds upon a foundation of mental sand, so to speak, and is professionally a failure. It is true that some one else usually pays for his blunders; but as long as the employers of engineers are short sighted enough to intrust their work to the cheapest man who styles himself an engineer, we certainly can not say that we are sorry for them. Corporations themselves are to-day mainly responsible for any bad work performed on their properties, for the reason that to-day competent, trained and experienced engineers can always be secured if the employer makes the attempt to seek them out and has the wisdom to pay for the best talent the work in question will demand. In brief, the real engineer of modern times, to whatever branch of the profession he may belong, is not born an engineer, nor does he grow, as Topsy grew to be an engineer. He must be made; and, like any other good machine, the finer the original material, the more perfect the workmanship and the more care used in adapting all the parts to the duty to be performed, the more certain and satisfactory will be the results obtained. * * * *

But while the young engineer should be well educated and well trained, strong of limb, full of energy, brave and just, it is yet proper to say that the possession of all this training, combined with the other qualities, does not necessarily make an engineer. He must add to this years of hard, practical experience and always remember that there is no royal road to success in his chosen profession. Many young men who have carried off the prizes of their college course and have graduated with all the honors, forget this and at first feel disappointed because they are barred out from the higher walks in their branch of science. But if the right stuff is in them they soon recover and realize the fact that technical schools do not turn out engineers, but only young men more or less thoroughly equipped for rapidly gaining the practical knowledge that is only obtained outside of schools. What they have gained in the schools is the ability to better think for themselves and better appreciate and weigh the experience that must come later, and this ability is worth all the time and hard work it has cost. Work alone makes the really great engineer; but if a man has to waste his time in picking up in twenty years or more of self-tuition what he might have gained in a four or five years' course of technical training, when his brain was yet young and receptive, he will rarely pass beyond the middle stage of professional rank.

What word is that composed of five letters from which if you take two one remains?—Stone. Take off the s-t leaves o-n-e (one) See?

A camel is said to be the most ill tempered thing in the world: it always has its back up.

TO A WATER-LILY.

As idly floatest in thy crystal dish,
Nor reck'st the griefs nor joys of changeful life,
Its glitt'ring triumphs nor disheart'ning strife,
How oft my heart hath framed the ardent wish
That it, like thee, might bask this life away,
Lulled to soft dreams by the sweet roundelay

Of whip-poor-will, and eke the soft-breathed sigh
Of gently crooning, balmy summer breeze,
That thro' the glinting leafy em'rald trees
Wafts to our ears its mournful lullaby.
The mists of Lethe then would damp my brow—
Forget each tender glance, each false-lipp'd vow!

K. C. Tapley.

From Frank Leslie's Weekly, Sept. 5th.

BUSINESS TRANSACTIONS,

The Almy Water Tube Boiler Co. of Providence, R. I., has done during the past year a very satisfactory amount of business. The'r patent sectional water tube boiler has given efficient service to the users. They have had no complaints. This boiler in every case has yielded results equal to and often beyond what has been claimed for it. Their boilers for marine work are in some of the fastest steam yachts on the Atlantic coast, in various passenger steamers, and has been placed in U. S. torpedo boat Stiletto. Their boilers for stationary work have given equally satisfactory results, and are being used for power in factories, coal elevators, draw bridges, for heating public institutions, and in large manufacturing establishments, as emergency boilers for fire pumps, being for this purpose able to raise steam in equal time with first-class steam fire engines. They are a great success. Experts having pronounced them the best sectional water tube boilers on the market.

NEW! NEW!

FOR MANUFACTURERS.

Who wants to buy a small new machine for imitation and exploration in America. Sole machine in the world of first necessity for manufacturers of chocolate, and patented only in Europe. Please address offers, if possible in German, to C. N. 27850, care Rudolf Mosse, Berlin, S. W. (Germany).

American Agricultural Machines Wanted.

A German wholesale firm, with English and German references, dealing in agricultural machines, wishes to buy for cash American agricultural machines of latest and approved construction and invites cheapest offers to be forwarded to F. A. 7071, care of Rudolf Mosse, Berlin, S. W. (Germany).

CHICAGO, MILWAUKEE & ST. PAUL RAILWAY.

Electric Lighted and Steam Heated Vestibuled Trains, with Westinghouse Air Signals, between Chicago, St. Paul and Minneapolis, daily.

Electric Lighted and Steam Heated Vestibuled Trains between Chicago, Council Bluffs and Omaha, daily.

Through Vestibuled Sleeping Cars, daily, between Chicago, Butte, Tacoma, Seattle, and Portland, Ore.

Solid Trains between Chicago and principal points in Northern Wisconsin and the Peninsula of Michigan.

Daily Trains between St. Paul, Minneapolis and Kansas City via the Hedrick Route.

Through Sleeping Cars, daily, between St. Louis, St. Paul and Minneapolis.

The finest Dining Cars in the World.

The best Sleeping Cars. Electric Reading Lamps in Berths.

6,100 miles of road in Illinois, Wisconsin, Northern Michigan, Iowa, Minnesota, Missouri, South Dakota and North Dakota.

Everything First-Class.

First-Class People patronize First-Class Lines.

Ticket Agents everywhere sell Tickets over the Chicago, Milwaukee and St. Paul Railway.

A Mechanical Engineer having had a large experience in a wide variety of engineering work, and possessing a high degree of ability in designing, estimating, supervision and economical management, desires engagemen . ddress "A E," Box 589, Ravenswood, Ill.

Map of the United States.

A large, handsome map of the United States, mounted and suitable for office or home use, is issued by the Burlington route. Copies will be mailed to any address on receipt of 12 cents in postage by P. S. Eustis, Gen'l Pass. Agent, C., B. & Q. R. R., Chicago, Ill.

An Opening.—A chief engineer of three years' experience in southwest Virginia, east Tennessee and North Carolina would like to meet one or two bright men with $100.000 each who could complete 15 miles of railroad on which $60,000 cash has been expended for grading this season. The present company are local men who have run out of cash, but the project is as good as ever, and the opportunity now occurs to take advantage of their misfortune. No debts are owing, no bonds have been issued, and about $150,000 of local bonuses are promised. The inducements to take hold are: when built this railroad will inevitably be required by the projected extension of a present large system; it will pay handsomely from the start; and, best of all, large mineral and timber properties can now be secured cheaply, whose value would be greatly increased by the completion of this railroad.

I have no money and no financial connections, but have this opportunity and can give the highest professional references. Address Chief Engineer, P. O. Box 360, Bristol, Tenn.

CONTRACTS OPEN.

United States Engineer Office, 34 West Congress street, Detroit, Mich., September 19, 1891. Sealed proposals, in triplicate, will be received at this office until 2 o'clock p. m., October 19, 1891, and then opened: For furnishing ten gate anchorages for the 800 feet lock at St. Mary's Falls Canal, Michigan. Preference will be given to materials of domestic production or manufacture, conditions of quality and price (import duties included) being equal. Attention is invited to Acts of Congress, approved February 26, 1885, and February 23, 1887, vol. 23, page 332, and vol. 24, page 414, Statutes at Large. The government reserves the right to reject any or all proposals; also, to waive any informalities. For further information apply at this office. O. M. Poe, Colonel Corps of Engineers, Bvt. Brig. General, U. S. A.

Building Materials.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until the 9th day of October, 1891, for all the labor and materials required for the excavation, concrete foundations, stone and brick work, iron and wood floor and roof construction, roof covering, etc., of the U. S. Post Office building at Jackson, Mich., in accordance with the drawings and specifications, copies of which may be had at this office. Each proposal must be accompanied by a certified check for not less than 2 per cent. of the amount of proposal. Proposals must be sealed and marked "Proposals for Excavation, Concrete Foundations, Stone and Brick Work, Iron and Wood Floor and Roof Construction, Roof Covering, etc., for the U. S. Post Office Building at Jackson, Mich.," and addressed to W. J. Edbrooke, Supervising Architect.

Steam Heating and Ventilating Apparatus.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until the 9th day of October, 1891, for all the labor and materials required for putting in place complete the low pressure, return circulation, steam heating and ventilating apparatus for the United States Post Office building at Kalamazoo, Mich., in accordance with drawings and specifications, copies of which may be had at this office. Bids will also be considered for any other system of heating and ventilating in lieu of the above, and parties proposing to supply such must submit, with their proposal, plans and full specification for same. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal. Proposals must be inclosed in envelopes, sealed and marked, "Proposals for the Low Pressnre, Return Circulation, Steam Heating and Ventilating Apparatus (or otherwise, as the case may be) for the United States Post Office building at Kalamazoo, Mich.," and addressed to W. J. Edbrooke, Supervising Architect.

Steam Heating and Ventilating Apparatus.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until the 6th day of October, 1891, for all the labor and materials required and fixing in place complete the low pressure, return circulation, steam heating and ventilating apparatus, power boiler, pump, etc., in the United States Custom House, etc., building at Galveston, Texas, in accordance with the drawings and specifications, copies of which may be had on application at this office. Bids will also be considered for any other system of heating and ventilating in lieu of the above, and parties proposing to supply such must submit with their proposal plans and full specification for same. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal. Proposals must be sealed and marked, "Proposals for the Low Pressure, Return Circulation, Steam Heating and Ventilating Apparatus (or otherwise, as the case may be), Power Boiler, Pump, etc., for the United States Custom House etc., building at Galveston, Texas," and addressed to W. J. Edbrooke, Supervising Architect.

Iron Work, Etc.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock p. m., on the 28th day of September, 1891, for all the labor and materials required for the iron stairs, iron work, etc., of elevator shaft, for the U. S. Court House, Post Office, etc., building at Denver, Col., in accordance with drawings and specifications, copies of which may be had on application at this office, or the office of the Superintendent at Denver, Col. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposals. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in envelopes, sealed and marked. "Proposals for Iron Stairs, Iron Work, etc., for the U. S. Court House, Post Office, etc., building at Denver, Col.," and addressed to W. J. Edbrooke, Supervising Architect.

OCTOBER 3, 1891. **The American Engineer.** VOL. 22, NO. 14.

THE MODEL MUNICIPAL ELECTRIC LIGHTING STATION OF ALEGHENY CITY, PA.

It is seldom that a central electric lighting station is so complete in its appointments that there is nothing to criticise or suggest.

The interior view of the Allegheny City plant is a good illustration of the degree of perfection possible in such a station.

After a thorough personal inspection of the different systems operated in the larger cities of the United States, the City Councils have incorporated all the points of advantage of each in their own, and have in consequcnce a very compact and efficient station.

It is essentially Westinghouse throughout, and consists of a series of independent units, any one of which may act as reserve without interfering with the operation of the others. This is probably the only plan of arrangement that would permit the concentration of so much power and capacity for lighting in so small a space.

In detail, the machinery consists of:

First.—Three 13& 22x13 Westinghouse compound engine belted direct to three 1,500-light Westinghouse alternating current incandescent dynamos, of which two are in general use, while the third is alternately used as reserve.

Second.—Four 13 & 22x13 and one 10 & 18x10 Westinghouse compound engines, belted to nine 65-light Westinghouse alternating current arc dynamos, of which four units are sufficient for the service, and the fifth acts as relay.

Third.—Two 6 ½x6 Westinghouse standard engines belted to two 100-light Westinghouse direct current dynamos for use as exciters of the field magnets of the alternating generators.

The engines are ranged in rows on each side of the room, and are belted to the dynamos in the center.

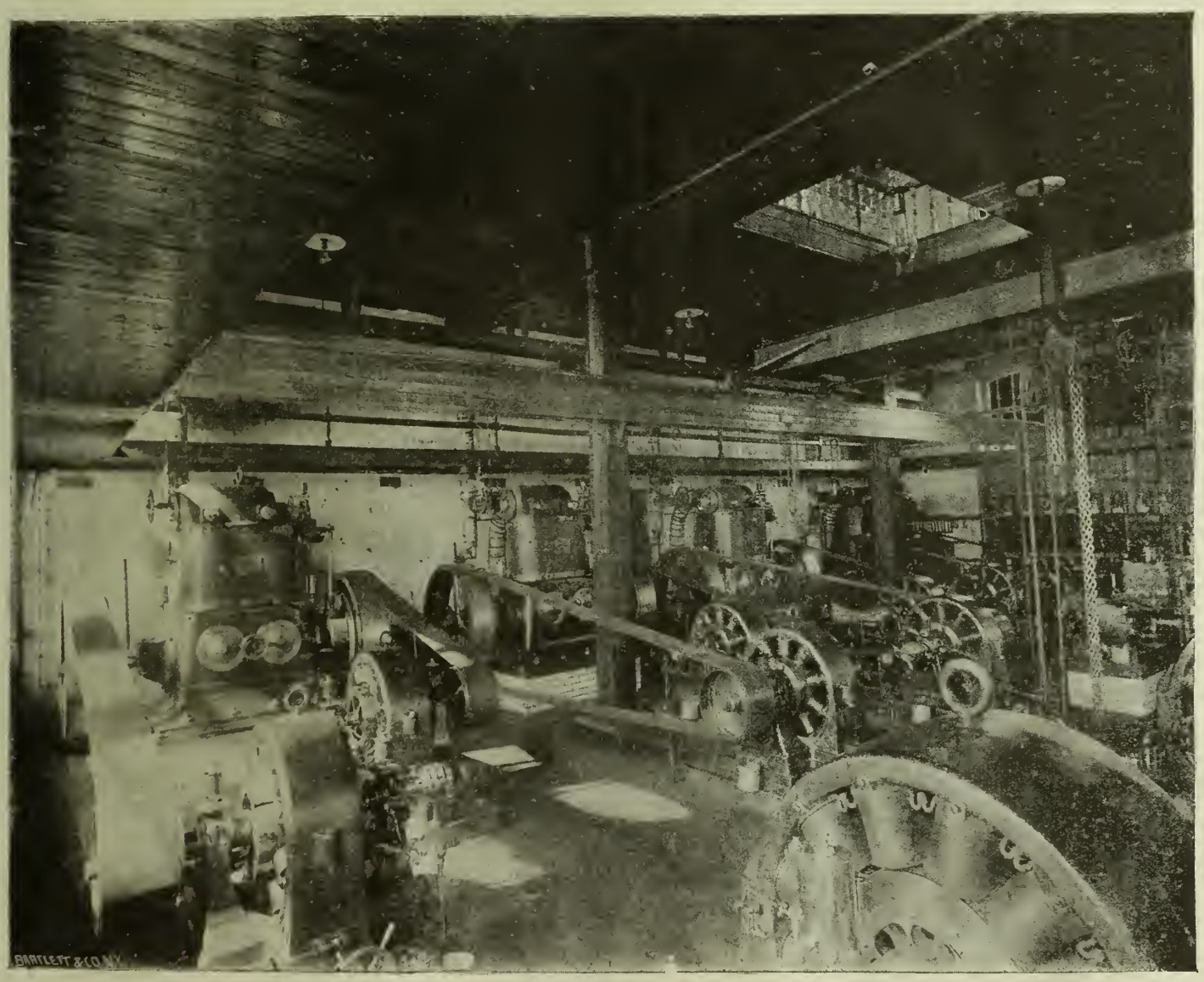
All this machinery, transmitting 1,000 h. p., and with a capacity for 4,500 incandescent and 540 arc lamps, occupies a floor space of but 56 by 57 feet. A 6-ton crane over the dynamos, and a 2-ton traveler over each row of engines, insures promptness in shifting or repairing.

In the boiler-room, the same careful attention to details is shown. Six 100 h.p. Erie boilers, of which one acts as reserve, are fitted. with Roney stokers, and the coal is loaded direct from the car into a tank traveling on an overhead rail, so hung as to empty the coal directly into the hoppers of the boilers.

Two pairs of duplex pumps and three injectors, either of which is sufficient for the purpose intended, are guarantees against accident to the feed-water supply.

The stokers are operated by a 4 ½x4 Westinghouse standard engine, whose motion is reduced through a screw gear, and a second engine duplicates the first, and is for use in case of accident.

The steam pipe is continuous, and any portion may be disconnected without interfering with the rest of the plant.



On the whole, this station is well designed, well lighted and well managed; and, with its interior finish of natural wood, always kept carefully clean, it presents an air of neatness in striking contrast to many larger and more pretentious stations.

The accompanying illustration is from a photograph.

THE SAND BLAST.

It is a strange matter that notwithstanding our boasted progress, the sand blast, so far as I know, has made but little progress in this country. The Tilghman Sand Blast Co., at Sheffield, Eng., uses at least 200 h.p. of steam in its operations, and the application elsewhere in Europe is extensive, but in the United States, for some reason, people have not availed themselves of it as they might have done for various purposes.

The main operation carried on at Sheffield is that of recutting files—not recutting old files, although some of that is done too, but recutting new files, to improve them; and here comes in another important discovery in this process. At some places in New England where a sand blast machine was employed, an attempt was made to clean a dirty file by holding it in the jet. The file was of course cleaned at once, but the effect was something more. The file, although a worn one, had all the characteristics of a new one, which, as all mechanics know is a very noticeable change. Other files were treated in the same manner with a similar result, and the discoverer proceeded to patent the process in this country, assigning the invention to Messrs. Tilghman for European countries.

Then began another round of experiments to determine the precise nature of the effect produced. The experiments extended to giving a certain number of uniform strokes with files and weighing the metal cut away. New files and old ones were treated, until the precise nature of the effect was learned.

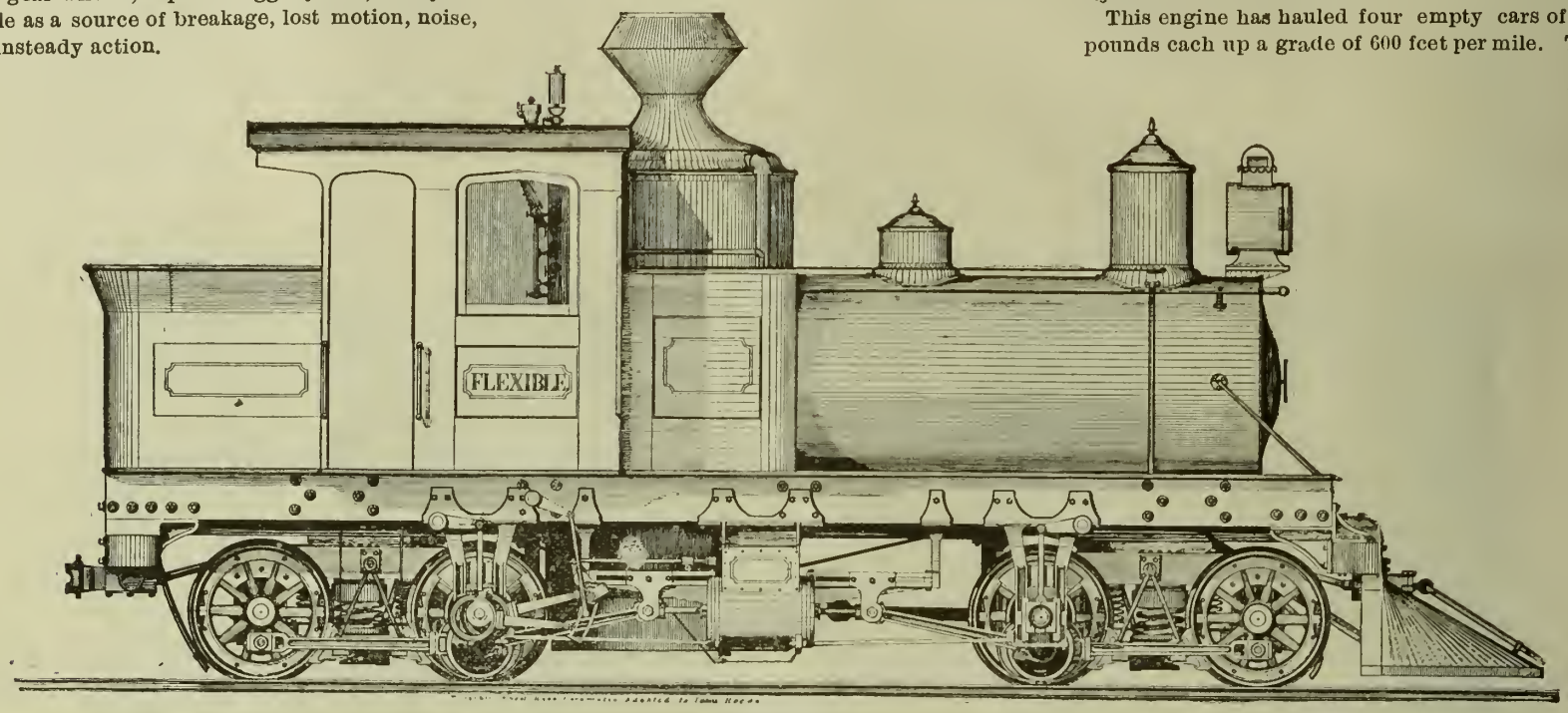
Every one knows how files are cut with chisels that raise up shavings or teeth. These are of curved form and with a thin edge that soon crumbles or breaks unless the cutting is skillfully done and the steel of good quality. When treated by the sand blast, the files are held at an angle, so the sand impinges on the back of the teeth, cutting away the thin edge, but not affecting the face, so the teeth become strong cutters, without the thin curled edge left by the chisels in cutting. The operation is very rapid, requiring but a few seconds, and the value of the files is much increased, so much so that a great many of the files made in Sheffield and on the Continent are treated in this manner. Sand, in the common sense, is not used in this process, but a mixture of sandy clay and water, thin enough to be circulated by pumps. This mixture of clay-water, it may be called, is drawn in by induction nozzles and discharged through a thin slit made in chilled cast iron tips that wear away very raidly.—John Richards in *Engineering and Mining Journal.*

A preventative against baldness: Celibacy.

NEW TYPE OF FLEXIBLE WHEEL BASE LOCOMOTIVE.

The engine illustrated is especially designed for use on tram roads having a very rough, uneven track with many heavy grades and sharp curves.

The object sought and attained in this engine is to produce, at a reasonably low cost, a thoroughly reliable and servicable locomotive, having the greatest possible traction power, by utilizing the entire weight, including fuel and water, for this purpose, combined with a degree of flexibility never before attained in a locomotive without the use of gear wheels, slip and taggle joints, so objectionable as a source of breakage, lost motion, noise, and unsteady action.



The entire weight of this engine is carried on two independent freely oscillating driving trucks swiveled to the engine frame like ordinary car trucks.

They are perfectly free to turn and follow curves, or twist to conform to an uneven track, without in the least interfering with the transmisston of the power from the engines, which are direct acting like any locomotive.

The principle of this locomotive will be easily understood from an examination of the simple line sketch of plan.

One axle, *a.a.*, in each truck is tubular. Through it passes the engine crank shaft *b. b.* They are coupled together in the center by a universal joint through these rings. They have the same play in them that the shaft has in the tubular axles.

It is obvious that while the crank shaft is maintained in the same position with reference to the engine frame, the trucks are free to oscillate in every direction to the extent of the play of the tubular axle and crank shaft, and at the same time the rotary motion is transmitted to all the wheels as rigidly as if the main rods were coupled directly to them.

The engine frame forms a platform on which the boiler, cab, fuel box, tank, etc., are placed. It is made with two strong sills lying directly over the cylinders, which performs much the same office as the bed plate of a stationary engine. Besides maintaining the engine in line, they also take all the working strain, relieving the trucks entirely of the thrust of the engine.

Besides the usual truck springs and equalizers, there are bearing springs between the trucks and engine frame. On a very rough, uneven track the engine runs as smoothly as a passenger coach.

The cylinders are placed midway between the trucks with piston rods extending through each head, one connected to the rear and one to the front truck. To compensate for the varying length of the main rods, owing to their angularity as the cranks approach the upper and lower points in their revolution, the piston heads are made double. One *h h*, annular is connected to one piston rod by a perforated disc. The one connected to the other rod *i i*, solid, fitting steam tight inside the first and having a longitudinal play equal to the variation to be provided for. Their arcars are equal and obviously steam acts on each with the same force. At the same time they are free to draw out to accommodate any variation in the length of the connections. They are provided with steam cushions, which prevent concussion in case the wheels of either truck slip.

The engine illustrated weighs eight tons which is equally distributed on eight driving wheels, 26" in diameter.

Width of gauge 42", length of truck wheel base 42" total wheel base 16'. It will turn curves of 50' radius and twist 10" in the length of its wheel base. Cylinders are 10" diameter by 12" stroke. They have balance valves and can be reversed undar full pressure slipping the wheels either way.

The trucks are provided with steam brakes which are also arranged to be worked by hand. Sand boxes are provided at each end. It will run and haul equally well either way.

The cab is roomy and neat making it easy and agreeable to fire and run.

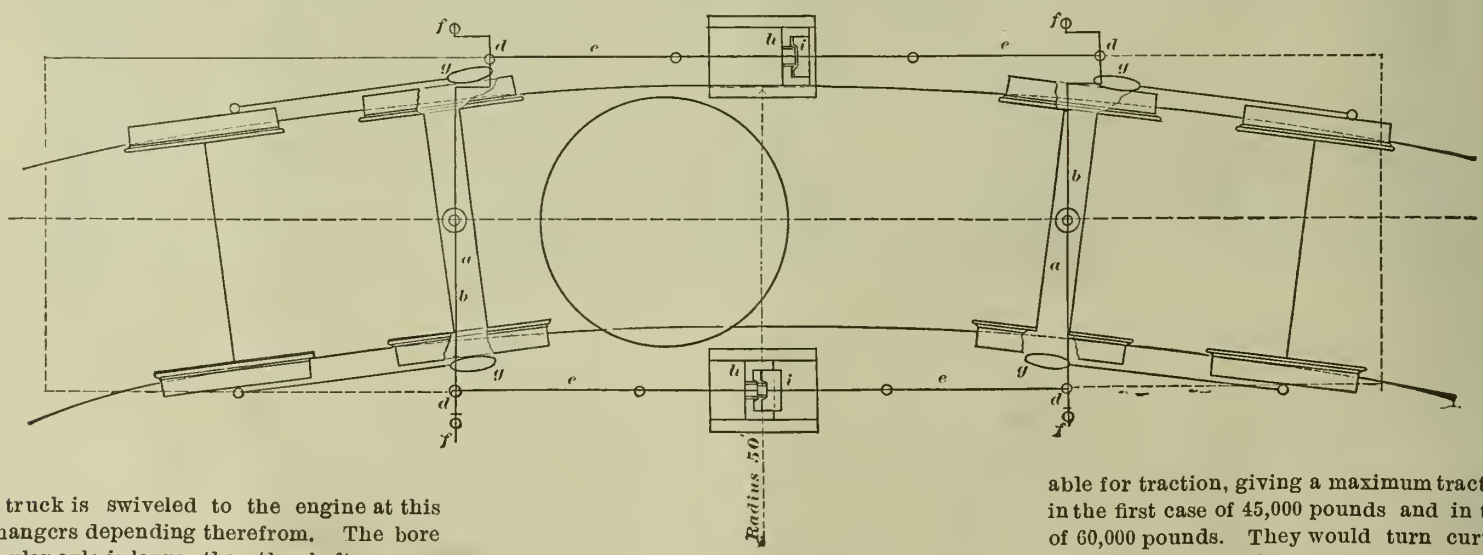
This engine has hauled four empty cars of 4,000 pounds cach up a grade of 600 fcet per mile. Turning curves of 50 feet radius, having a grade of 450 feet per mile, at the rate of 12 miles per hour. It has run on a reasonably straight track at the rate of 25 miles per hour, and this on 16-pound rail.

This type of locomotive is well adapted to all classes of railroad work, especially for elevated roads and dummy lines.

For suburban traffic, requiring frequent stoppages, its great tractive power gives it peculiar advantages for lifting heavy trains into full speed possessed by no other type of engine.

For heavy mountain grades the trucks can be made wtth six or eight wheels giving twelve or fourteen drivers with 96 or 130 tons weight available for traction, giving a maximum traction power in the first case of 45,000 pounds and in the second of 60,000 pounds. They would turn curves of 250 feet radius. One other advantage peculiar to this type is, there are few restrictions as to size or shape of boiler. They can be made of greater capacity. This is especially the case with the fire box.

Further information may be obtained of the inventor, H. E. P. Cowles, New Decatur, Ala.



c c. The truck is swiveled to the engine at this point by hangers depending therefrom. The bore of this tubular axle is larger than the shaft.

On each end ot the shaft, just outside of the wheels, is a double crank *d d d d*, to which the main rods *e e e e* of the engines are coupled. These cranks have journals outside with bearings *f f f f*, sliding vertically in hangers depending from the engine frame.

The hangers maintain the crank shaft always at right angles to the longitudinal axis of the engine, while they are maintained parallel to the plane of the framc by rock shafts with arms connected to the bearings *f*.

The wheels of the tubular axles have ring—like crank pins *g g g g*, coupled to the other wheels of the trucks. The wrists of the double cranks pass

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Sir Henry Wood, of the British Royal Commission, says that it is the present intention of the Commission to build at the Exposition a typical old English manor, or hall, as the English headquarters. He says also that an exact reproduction of Shakespeare's house at Stratford-on-Avon will be built if the necessary space can be secured.

LOCALIZATION AND REMEDY OF TROUBLES IN DYNAMOS OR MOTORS.—II.

By Prof. Francis B. Crocker and Dr. S. S. Wheeler.

Continued from page 123.

3rd Cause.—*Commutator (a) rough, (b) eccentric or (c) has one or more "high bars" projecting beyond the others*, or (*d*) one or more flat bars, commonly called "flats," any one of which causes brush to vibrate or to be actually thrown out of contact with commutator.

Symptom.—(*e*) Note whether there is a glazed or polish on the commutator, which shows smooth working; (*f*) touch revolving commutator with tip or finger and the least roughness is perceptible. If the machine runs at high voltage over 250, the commutator should be touched with a small stick or quill to avoid danger of shock. In the case of an eccentric commutator, careful examination shows a rise and fall of the brush when commutator turns slowly.

REMEDY.—Smooth the commutator with file or fine sandpaper (in latter case be careful to remove sand and *never* use emery), or if commutator is very rough or eccentric, turn it off with a fine cut in a lathe.

In order to have the commutator wear smooth and work well it is desirable to have the armature shaft move freely back and forth about one-sixteenth or an eighth of an inch in the bearings, and the position of the bearings, pulley, collars and shoulders on the shaft and of the machine with respect to the belt should be such as to cause this to take place of itself. (See Heating of Bearings, No. 6.)

4th Cause.—*Brushes make poor contact with commutator.*

Symptom.—Close examination shows that brushes touch only at one corner, or only in front or behind, or there is dirt on surface of contact.

REMEDY.—File, bend, adjust or clean brushes until they rest evenly on commutator with considerable surface of contact and with sure but light pressure.

(See directions for care of brushes below.)

5th Cause.—*Short-circuited coil in armature.*

Symptom.—The particular commutator bar connected to short-circuited coil is burnt by the spark which occurs when brush passes over it.

The short-circuited coil is heated much more than the others, and is very apt to be burnt out entirely; therefore stop machine immediately. If necessary to run machine to locate the short circuit one or two minutes is long enough, but it may be repeated until the heat of the short-circuited coil is found by touching the armature all over. Considerable power is required to run armature free. An iron screwdriver or other tool held near the revolving armature vibrates perceptibly as short-circuited coil passes. Current pulsates and torque is unequal at different parts of a revolution, these being particularly noticeable when armature turns rather slowly.

REMEDY.—A short circuit is often caused by a piece of solder or other metal getting between the commutator bars or their connections with the armature, and sometimes the insulation between these bars is bridged over by a particle of metal. In any such case the trouble is easily found and corrected. If, however, the short circuit is in the coil itself, the only real cure is to rewind the coil.

In an emergency a short-circuited coil may be temporarily cut out by connecting together the two commutator bars to which its terminals are connected or the two adjacent coils, as described in the Remedy for Sparking, No. 6. But be sure to unwind or open the circuit of the short-circuited coil, as otherwise the trouble will continue.

6th Cause.—*Broken circuit in armature.*

Symptom.—Commutator flashes violently while running and commutator bar nearest the break is badly cut and burnt, but in this case no particular armature coil will be heated, as in the last case (No. 5), and the flashing will be very much worse, even when turning slowly. This trouble, which might also be confounded with a bad case of "high bar" or eccentricity in communicator (Sparking, No. 3), is distinguished from it by slowly turning the armature, when violent flashing will continue if circuit is broken, but not with eccentric commutator or even with "high bar," unless the latter is very bad, in which case it is easily felt or seen.

REMEDY:—The broken circuit is usually found where armature wires connect with commutator, and not in the coil itself, and the break may be repaired or the loose wire may be resoldered or screwed back in place. If the broken commutator connection cannot be fixed, then connect the disconnected bar to the next by solder, or "stagger" the brushes; that is, put one a little forward and the other back so as to bridge over the break. If the break is in the coil itself, rewinding is generally the only cure. But this may be remedied temporarily by connecting together by wire or solder the two commutator bars or coil terminals between which the break exists. It is only in an emergency that armature coils should be cut out or commutator bars connected together, or other makeshifts resorted to, but it sometimes a very undesirable stoppage. A very rough, but nevertheless quick and simple way to connect two commutator bars is to hammer or otherwise force the copper together across the mica insulation at the end of the commutator. This can be afterwards easily picked out and smoothed over. In carrying out any of these methods care should be taken not to short circuit an armature coil, which would cause Sparking, No. 5.

7th Cause.—*Weak field magnetism.*

Symptom.—Pole-pieces not strongly magnetic when tested with a piece of iron. Point of least sparking is shifted considerably from normal position, due to relatively strong distorting effect of armature magnetism. Speed of a motor is usually high unless magnetism is very weak or nil, in which case a motor may run slow, stop, or even run backwards. A dynamo fails to generate the full E.M.F. or current. The particular cause of trouble may be found as follows: A broken circuit in the field is found by purposely opening the field circuit at some point, taking care to first disconnect armature (by putting wood under the brushes, for example) and to use only one hand to avoid shock, and if there is no spark there must be a broken circuit somewhere. A short circuit is found by measuring the resistance roughly to see if it is very much less than it should be, and usually a short circuit is confined to one magnet and will therefore weaken that particular one most, and a piece of iron held half way between the pole-pieces will be attracted to one more than the other. "Grounding" is practically identical with short circuiting, since one ground would not produce this effect until another occurred, and then we should have a double ground which is equivalent to a short circuit.

REMEDY.—A broken or a short circuit or a ground is easily repaired if it is external or accessible. If it is internal the only remedy is to re-wind the faulty coil.

To be continued.

A TRICYCLE PROPELLED BY THE ARMS.

The cycling world, says a city contemporary, has been increased by a novel invention in the shape of a tricycle which is propelled by the arms and not by the feet, and the action employed is exactly like that required for rowing a boat. The machine is fitted with a sliding seat, which minimises the exertion necessary for driving the machine at a high rate of speed. The feet are used for steering purposes, and the new invention is adapted for ladies or gentlemen, and especially for invalids. A peculiar feature is that the vehicle is without chains, cog-wheels, or cranks, and it is propelled by means of a central pull on a single cord from the front by means of a cross handle, attached to which is a leather strap. The mechanism employed is extremely simple, but cleverly arranged. The inventor is Mr. S. Kemp, 18 Holbeck road, Kennington Church, S. W., who some years ago experimented successfully in an improved means of deep sea trawling.—*Invention.*

Thrown together a great deal: Dice.

ELECTRICITY AND LIFE.

It seems to be a pretty well-established fact that electricity may be made at least a powerful stimulant to the growth of plants. May it not be more than a mere stimulant? May it not be an actual creator of life? Beans, rye, corn, oats, barley, peas, potatoes, sunflowers, clover and flax, have all been experimented upon, in some cases with astonishing results. In one series of experiments the seeds were electrified before they were sown; in another, currents were maintained through the soil in which they were planted; and still another, through the atmosphere immediately above the plants. In several instances the yield of fruit was enormously above the average, and in all the growth was unusually luxuriant. Further experiments are in progress, and it is not unlikely that science is about to add another to her long series of benificent triumphs, another refutation to the croaking philosophy of Malthus and his disciples.

The results of the experiments have, furthermore, a suggestive bearing upon the relation between electricity and that inscrutable something which we call life. If they do not prove them, the same they at least bring them nearer together than any phenomena which have preceded them. When, in the healing art, enfeebled vitality is restored, either wholly or in part, by the skillful application of electricity, nothing is positively demonstrated beyond mere healthful stimulation, the mere awakening of life which already lay dormant in the system, such as might possibly have followed the use of other remedial agents. But here it is not morbid, restored to normal conditions, not dorman life reawakened to action. It is apparently the actual development of vitality not preexistant in the perfectly healthy and normal organisms under treatment. Electricity itself appears to be converted to vitality, as elsewhere it is convertible to light, heat and mechanical motion.

Whether life can thus not only be renewed but actually transfused into the veins, or rather, the nerves of man, remains for physiological science to determine. It has already been shown that a living body is a species of thermo-electric battery, of which the ectoderm and the endoderm are the opposite poles; and the exhilerating effects of a cold plunge, for example, are due simply to the increase of potential from the reduced temperature of the "cold" electrode. But merely setting a battery into operation, or merely increasing its action, is not increasing its inherent voltago, which is what the recent experiment seems to have done for plants.

But do not heat and the active principle of light artificially intensified produce similar effects? The forcing of vegetable growth in hot-houses is an old process and unlike the one in question, both in method and effect. According to the reports given, however, there is a very great difference in the results attained. If this be true, it would seem to indicate more strongly than ever that of all forms of natural force, electricity bears the closest relation to that mysterious form of it which we call life.—Edward P. Jackson, in *North American Review.*

AN ENGINEER'S HEROISM.

The Cincinnati *Enquirer* tells the story of a remarkable act of bravery on the part of Engineer Martin Winters, of the Pan Handle road. Sixty miles east of Columbus, recently, the driving rod of an engine pulling an excursion train broke as the train was running at a speed of forty miles an hour. In its revolutions it broke one of the driving wheels, badly dismantled the engine, and demolished the cab. Yet the engine did not leave the track. The accident had destroyed the appliance for setting the air brake, and with the engine wabbling to and fro as it sped along the track, the engineer, with monkey wrench in hand, climbed down under the first car at the peril of his life and set the air brakes, which brought the train to a stop. The passengers came out of the cars to ascertain what was the matter, and when they saw what a narrow escape they had had, the accident having occurred on a high embankment, they were so thankful that a handsome sum of money was raised for the heroic engineer.

The American Engineer.

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ELECTRIC AND ELECTRICAL.

According to the dictionaries these terms are synonymous. But in practical use there is a marked difference in their application. It would sound rather ridiculous if any one was to ask, "Have you bought any electric books lately?" And it is not usual to say "electrical light." The rule seems to be to use the affix al when referring to anything pertaining to electricity, and drop it when referring to anything in which electricity itself is an essential element. For instance, we say electric motor, or electric machine, when the motor or machine is used for generating or regenerating electricity. Electric wires are those which conduct electricity. Electric light is that which is produced by electricity. And we say electric lamps because electric light is in them. But we say electrical books, electrical knowledge, electrical mechanics, and electrical investments; for those things are not electric, that is electricity is not an essential element in them, they only pertain to electricity. Thus we have electrical used as part of the names of electrical journals, such as *Electrical Review*, *Electrical Industries*, *Electrical Enterprise*, *Electrical Engineer*, and *Electrical World*. There are two exceptions to this rule. The *Electric Age* is a name in the list of New York publications; so is *Electric Power*. Those who named the *Age*, evidently did not know the difference between electric and electrical, and it is as improper to say *Electric Age* as it is to say electric book, or electric literature, or electric dictionary. As for *Electric Power*, this is a mongrel term altogether, as the name of a periodical. There cannot be electrical power, in the ordinary sense. If power at all, derived from electricity, it must be electric. And the termination al is rightly dropped in such a name, but *Electric Power* is an electrical publication for all that.

BOILER EXPOSIQN KILLING THREE.

A dispatch of Thursday last week, from Tionesta, Pa., says that the boiler of Roslin's new sawmill at Bear Creek, twelve miles from that place, exploded that morning, completely demolishing the mill and instantly killing J. Elva Berlin, James Conger, and Charles B. Crove, all well-known lumbermen. The bodies of Crove and Berlin were horribly mangled, while that of Conger, although blown fully 200 feet, was but little bruised.

ANOTHER BOILER EXPLODED.

From a communication from Steubenville, O., enclosing a newspaper clipping without date, it appears that about 9 o'clock in the morning (what day is not stated) the steam boiler of a portable threshing machine belonging to Arch Porter, while at work at the McConnell farm, in Cross Creek township, three miles west of Steubenville collapsed wrecking the threshing machine. Frank Maxwell was seriously scalded. Arch Porter, Thomas Quillen, Henry Perman, and Alexander Clifton were also scalded, but not so badly as Maxwell.

MORE BRITISH BOILER EXPLOSIONS.

A formal investigation under the Boiler Explosion Act, 1882, was recently held at Bacup, and dealt with an explosion which occurred on Wednesday July 22, at Britannia Stone Quarries, owned by Messrs. Brooks. The following abstracts are from *Engineering:*

The boiler which was made in 1878, was a small one of the vertical internally fired type, used for working a crane for hoisting stone obtained from the quarry. Its height was 5 ft. 7½ in., its diameter 3 ft. 5½ in., and the plates ⅜ in. thick. Messrs. Brooks purchased it in September, 1890, at an auction, but no thorough examination was made at the time, and it was set to work with the safety valve loaded to 70 lb. The large horizontal boiler used at the quarry was regularly inspected by the Manchester Steam Users' Association, but the vertical boiler was under no insurance or independent inspection, the idea of the owners and their manager being that small boilers of that type did not need a thorough examination periodically. If anything appeared wrong it was the manager's duty to call in a practical boilermaker, and to act on his advice. Slight corrosion of the firebox was noticed in the early part of July, but no danger was anticipated On the morning of July 22 work was started as usual, and shortly after eight o'clock a pressure of 57 lb. was reached. Within a short time of this the boiler burst, and was shot up into the air to a height of about 100 ft., falling nearly 200 yards away. Fortunately, just before the explosion the men had ceased work on account of the rain, and had sought shelter in a hut away from the boiler, so that no personal injury resulted.

Mr. Seaton, engineer-surveyor to the Board of Trade, attributed the explosion to the weakness of the firebox through the plate being wasted by internal corrosion to a thickness in places of 3-16 in.

Mr. Wyld, manager at the quarry, stated that a laborer named Rushton, had confessed that he had tampered with the safety valve by putting a small nail under the lever, and that he had been dismissed for doing so.

Rushton was called as a witness and confirmed the statement that he had inserted the nail, adding that he did so because the workmen complained that they could not get steam enough. The workmen in giving evidence denied that they had made such a complaint.

Mr. Howard Smith, in giving judgment, said that Messrs. Brooks and Brooks were to blame for the explosion, and must therefore pay the sum of 40*l* towards the costs and expenses of the investigation. The Court considered that Rushton was telling the truth when he said that he had put a nail under the safety valve lever, but in their opinion such tampering did not materially affect the result. The pressure at which the boiler was ordinarily worked was much too high considering the corroded condition of the firebox.

Another formal investigation took place at Bolton, and referred to an explosion which occurred on Wednesday, August 12, at the King's Arms Hotel Brewery, Farnworth, owned by Mr. Thomas Ball.

From Mr. Gough's opening statement it appeared that the boiler, which was of the vertical internally fired class, was made in 1879, and measured 5 ft. in height, by 2 ft. in diameter. It had no manhole and no manhole doors, nor were there any stays to tie the firebox to the shell. The boiler was bought in 1879 by Mr. Ball from a Mr. Nelson, who had purchased it from the maker but was not able to use it. Without calling in an expert to examine the boiler Mr. Ball judged that it would stand a high pressure, and therefore fixed the safety valve to blow off at 60 lb., though he usually worked at 40 lb. The boiler was never examined by any qualified person during the twelve years it has been in Mr. Ball's possession, because, as he confessed, he did not think an examination was necessary, and it was so constructed that there was no looking inside it. About 2 p. m. on August 12 the explosion occurred, the boiler being shot upwards through the roof of a shed, damaging the wall and chimney, and falling about 70 ft. from its original position. Examination showed that the shell was sound but that the firebox was so wasted by corrosion that it was only 1-16 in. thick in places. Mr. Ball in evidence said he thought the boiler perfectly safe for 80 lb. pressure, and in fact he would not have been afraid to put another 50 lb. on it. Mr. Shott, engineer-surveyor to the Board of Trade, presented a report, and stated that the top of the firebox was not fit for any pressure. Even when new it ought not to have been worked at more than 15 lb. or 20 lb. The bursting pressure he had calculated was 90 lb.

In giving judgment Mr. Howard Smith said that the boiler was not properly constructed in being without a manhole, and that Mr. Ball had actedly recklessly in not ascertaining at what pressure it could be safely worked in the first instance, and in never having it examined by a qualified person. The Court held that blame attached to Mr. Ball, but thinking he had acted more from ignorance than anything else, they would not make a large order as to costs. They directed him to pay 15*l*. to the Board of Trade towards the costs and expenses of the investigation.

The attention of those steam users who work small vertical boilers, such as those dealt with in two of the investigations just reported, should be directed to the fact that numerous explosions have recently occurred from this class of boiler, says *Engineering*, and that all such boilers require systematic and careful inspection. Being small they are apt to be treated with indifference. This, however, is most unwise, and many owners have from time to time found this out to their cost. In our cities and towns these vertical boilers are in constant use and frequently in connection with the erection of public buildings, etc. It will be obvious that every precaution should be exercised to secure complete safety, but in far too many cases, as is shown by the reports issued by the Board of Trade, the boilers are left to take care of themselves and to explode or not as circumstances may dictate. This is an unsatisfactory state of affairs, and if boiler owners will not take the initiative into their own hands, and adopt a system of voluntary inspection, which it appears they too often are disinclined to do, there is little doubt that a more stringent measure will have to be enforced. In the first of the investigations (reported last week) the boiler had run for twenty-five years without proper examination; in

the second the boiler had been bought at auction and set to work without inspection, and in the third no examination had been made for twelve years. These facts speak for themselves and point their own moral.

"WHAT IS AN ENGINEER?"

The last answer to this question, which is now being repeated more than enough, is the *Boston Journal of Commerce*, which says:

We are in receipt of the following communication from some one who signs himself "Mixed Up:"

"Will you, in your engineering notes, define, or, in other words, state what an engineer is? I notice that the man that starts and stops the engine is called the engineer, no matter if the engine is only 'one-rat power.' In looking over some old books I find such terms as these used: 'Engine man,' 'engine tenter,' 'engine winder,' 'engine driver,' 'engine minder,' 'locomotive driver,' 'stationary engine tenter;' also, 'consulting engineer,' 'mining engineer,' 'civil engineer,' 'chief engineer to such-and-such railway company!" Now will you please inform your readers what kind of an animal an engineer is? I do not think an engineer is an 'engine tenter.' To me it looks too much like engine tenter mixed up with 'eer.' I have been asked many times if I thought the man that starts and stops the engine is an engineer. I always answer, no!"

Strictly speaking, we are inclined to think that any one who guides or controls mechanism is an engineer, and must have a prefix to designate what he specially is fitted to guide. A man may be said "to engineer" a certain scheme and be called therefrom the engineer. There is really nothing about any word that gives it a meaning other than what common usage has given it, and, if there is, then this usage will change it in time. The popular mind calls the man who tends the engine the engineer, but the engine-tender expresses it better if one is inclined to believe engineer should apply only to the higher branches of the profession. But these are known by prefixes that designate their particular branch in the whole engineering profession and we have the civil engineer, the mechanical engineer for the man who is more learned in the same class as the engine driver, the military engineer, and others, while the word engineer covers the whole class. There are, doubtless, locomotive engineers, marine engineers and stationary engineers, who are doing work as engine tenders yet as well posted in the engineering profession as those who are called mechanical engineers. Thep are simply doing a different branch of the work and are in every sense of the word engineers, and their special work is defined by the prefix. If the locomotive engineer knows no more than to keep his locomotive in good running order, or the stationary engineer make his engine do its work, they are entitled to be classed as engineers. The man who has charge of an engine, starts and stops it every day, and looks after it, is an engineer, but a stationary engineer; yet it seems that he hardly deserves the name if he can do no more than this. People expect a stationary engineer to know all about his engine and be able to cope with any emergency that may arise in its care, and so give to all who hold that position the name of stationary engineer, very properly; but if he cannot do this, or can do little more than start and stop her, he is no more an engineer though he may be called so. He is merely given the benefit of the name in expectation that he knows his business. Such a man is not an engineer.

ON TRIAL FOR MANSLAUGHTER.

Nevada City, Sept. 22.—The trial of McDougal, charged with manslaughter, in fatally beating Michael Lanahan over the head with a pistol at Truckee on July 6th, began in the Superior Court this morning. Both men had been drinking, and Lanahan was twice disarmed by outsiders shortly before the fight when about to attack the defendant with a revolver. Many Truckeeites are here as witnesses.—*Sacramento Union.*

Iron is good for the blood, but no man likes to have it administered in the form of carpet tacks.

A NEW DEPARTURE.

The new management of this paper have decided to add a "Women's Department" to its special features. This is done primarily in the interests of the Daughters of Fulton, and next this department will be of special interest to every mother, wife, sister and daughter of an engineer who is a member of the A. O. of S. E.

Articles interesting to women and woman's life will be written specially for this new department of The American Engineer, and these columns will be open to any one having original or educational ideas tending to the elevation and advancement of the women connected with the American Order of Steam Engineers. Frivolous matter will always be barred, but everything welcomed that will tend to lighten life's burden, or brighten the homes of our engineers.

This department will be under the management of a competent editress; and it is expected, inasmuch as it is primarily for home education, that she will be ably assisted by the Daughters of Fulton, and others, who desire to contribute to make it a desirable and pleasure-giving addition to this paper.

We solicit the good will of the women, and they have great power to wield inasmuch as weak man is always subservient to their whims.

The Editor.

CIVIL ENGINEERS' CLUB OF CLEVELAND.

At the Club's last regular meeting, President Gobeille read an interesting paper entitled "Straw and Corn on the Cob as Fuel for Domestic Purposes," in which it was stated that it had been found from experiments that the same quantity of heat could be generated by the combustion of straw or corn on the cob, pound for pound, as could be generated by the combustion of any other fuel. One of the principal difficulties in designing stoves for burning straw is to provide for the liquid products of combustion which are comparatively large in quantity.

Several drawings of different stoves, designed for burning straw were exhibited, also diagrams showing temperature curves obtained by platting colorimeter and pyrometer readings from experiments recently made. The difficulties of burning lignite, and the need of stoves suitable for burning this material, which abounds in many parts of the country destitute of true coals, was also discussed. The results of ten experiments were platted against lines derived from similar treatment of bituminous coal.

THE ENGINE "CHARLES DICKENS."

The publication of "unpublished correspondence" of Charles Dickens has been a feature in England recently. And the work performed by a locomotive is published in the correspondence columns of *Engineering* under the caption "Further Unpublished Correspondence' from 'Charles Dickens' on Engine Mileage," as follows:

Sir:—Some hitherto unpublished correspondence of Dickens having been recently given to the world and more being in request, I have thought the public, especially of Manchester, and those engaged in the mechanical engineering profession, would regard as opportune and otherwise appreciate a further contribution of the kind direct from myself.

It will be remembered from my already published correspondence how I was turned out of the Crewe Works on February 6, 1882, sent to Longsight to run as often as I could between Manchester and London, as a minimum day's work, in charge of David Pennington and Leigh Bowden, taking the 7.45 a. m. train out of Manchester, and returning with the 4 o'clock out of London, and was so regularly on the road, in fair weather and foul, in snow and rain, that by September 7, 1886, when my performance had just exceeded half a million of miles, the friends I had so often carried safely had christened the trains I worked the "Charles Dickens," and had ceased mentioning the times of departure when making their traveling arrangements.

On March 17, 1886, I lost my faithful groom, David Pennington, through his eyesight being unfortunately injured, but Josiah Mills, who succeeded him, together with his mate, Leigh Bowden, who has been with me from the commencement of my career, have been so attentive to my various daily wants that to-day, when about half way between Mow Cop and Harecastle, on my 2,651st trip to London and back, I accomplish the, so far as I know, unparalleled feat, either on this or the other side of the Atlantic, of running 1,000,000 miles in 9 years and 219 days. In addition to the 2650 trips to London and back, I had run 92 other trips, consuming 12,515 tons of coal and evaporating 93,237 tons of water. Although it may seem more extraordinary than my athletic achievement, through the effective arrangement of my designer, and the convenient interchangeable system peculiar to the Crewe creations, I have had two new digestive organs supplied to me since my birth, but such has been the quality of the food and medicines received throughout that neither these nor the originals are yet worn out, in fact the first were in such excellent condition that after I laid them aside, my sister "Snowdon" travelled 191,236 miles with them, "Balmoral" afterwards appropriating them, and still running with them. "Courier" became enamoured with my second, and is making a good record therewith. My third will, I hope, raise the steam for me for many a day to come; and I myself trust to witness, with many old acquaintances, the dawn of the 20th century, although whether my constitution will hold good for another million of miles remains to be seen. At present I feel no symptoms of decay; all my energies are unimpaired, and by the kind indulgence of my master, I and my grooms are just off to enjoy a week's holiday during the gloriously fine weather now prevailing. I am, etc.

"Charles Dickens" (Engine No. 955),
Longsight Station, London and North-Western Railway, September 12, 1891.

WATER AS A MEDICINE.

The human body is constantly undergoing tissue change. Worn out particles are cast aside and eliminated from the system, while the new are ever being formed, from the inception of life to its close.

Water has the power of increasing these tissue changes, which multiply the waste products, but at the same time they are renewed by its agency, giving rise to increased appetite; which in turn provides fresh nutriment. Persons but little accustomed to drink water are liable to have the waste products formed faster than they are removed. Any obstruction to the free working of the natural laws at once produces disease, which, if once firmly seated, requires both time and money to cure.

People accustomed to rise in the morning weak and languid will find the cause in the imperfect secretion of wastes, which many times may be remedied by drinking a full tumbler of water before retiring. This very materially assists in the process during the night, and leaves the tissues fresh and strong, ready for the active work of the day.

Hot water is one of our best remedial agents.

A hot bath on going to bed, even in the hot nights of summer, is a better reliever of insomnia than many drugs.

Inflamed parts will subside under the continued poultising of real hot water.—*Mfrs. Gazette.*

MISCHIEVOUS SAFETY VALVES.

An engineer, speaking of neglected safety valves, said: "Safety valves that stick will stick even though tried every day, if they are simply lifted and dropped to the old place on the seat again. If a boiler should be found with an excessively high pressure, it would be one of the worst things to do to start the safety valve from its seat unless extra weight was added, for should the valve once start, it would so suddenly relieve the boiler of such a volume of steam as would cause a rush of water to the opening, and by a blow just the same as in water hammer rupture the boiler. Such a condition is very possible to occur of itself when a safety valve sticks. The valve holds the pressure, that gets higher and higher, until so high that the safety valve does give way and allows so much steam to escape that the sudden changing of conditions sets the water in motion, and an explosion is the result."

A country seat: The milking stool.

"THE CHANNEL TUBULAR RAILWAY."

This is the title of a paper read by Sir Edward J. Reed, before the British Association at Cardiff last August. As mentioned in our last issue, a tunnel under the English Channel has been "projected" many times, but is not likely to become an accomplished fact so long as the existing "balance of power" is maintained in Europe. At the same time what the paper set forth is interesting.

Among the earlier railroad proposals were several, said Sir Edward, for constructing metallic tubes upon the bed of the channel. The sea in the channel is everywhere of very moderate depth, and where the bottom is not practically level, its departures from the level are surprisingly small and gradual. The depth of the channel nowhere reaches 200 feet upon the selected line between England and France. For several miles out from the English coast it is not 100 feet deep; and the greatest depth is, roughly speaking, about two-thirds of the way across to France, and there its maximum is 186 feet. A railway across this piece of submarine ground is as good as any other railway. The fact that it is a railroad within a perfectly water-tight and durable tube—or pair of tubes, for there would be a tube for each line of railroad—completely renders the presence of the sea water outside of it of no consequence. The securing of these tubes in place, and the ventilation of them, led on to the details of the system. The necessity which enforces the use of water tight tubes for the purpose is attended incidentally by great advantages.

The tubes, said the author, "would be of iron or steel in so far as the primary and essential elements of their structure are concerned; and this at once, and obviously, relieves us almost entirely, if not altogether, of the cost, the difficulty, the delay, and the danger of doing our construction work at the bottom of the sea. These tubes can be perfectly well built by our shipbuilders and engineers, and partly by France, just as ships are built, but with much greater economy. The tubes thus made will be towed by steamers from the building ports to the channel as they are required for being laid in place, and the operation of laying them is one which has been very carefully studied and worked out in order to make it safe and certain. To this end had been devised the system of making the length of tube which has last been laid the means and the instrument of bringing the next length into its position with unerring accuracy. It is difficult to explain in words alone the operation of laying the tubes. But, obviously, if one end only of a buoyant tube is forcibly taken down from the surface of the water to the bottom, or nearly to the bottom, the other end will float and rise somewhat above the surface. This being so, a pier wholly afloat at the time is brought up to the emerged end of the tube, and coupled up to it by enormous hinge joints. The next length of floating tube is then brought up to the other side of the floating pier, and similarly jointed to it. The pier is now sunk by suitable means and under proper control, and as it goes down carries with it the second end—so to speak—of the first named tube, and the first end of the last named tube. The other end of this latter tube floats, of course, and the operation is repeated. In this manner tube after tube is laid, with piers between the successive lengths, until the whole is accomplished. The lines of railway, of course, pass continuously through the piers as well as the tubes. The whole operation is like the paying out of a hugh cable, link by link; tubes and piers alike forming, as it were, the links of the cable. The approximate cost will be between 12 and 15 millions sterling."

The author then dealt with the question of national security, which many suppose the channel tunnel to threaten. In the case of the channel tunnel, were that carried out, it would undoubtedly afford a subterranean military road, which, were it once secured by an enemy, might, in the opinion of many, "be held in spite of us, because this subterranean road, being deeply situated below the channel bed, would be completely preserved from attack by the British navy. The channel tubular railway, on the contrary, is everywhere situated above the bed of the channel, and could, therefore, be attacked at every point by dynamite. At the same time it is so constructed and brought up along the foreshore—at a gradient of 1 in 80—as to be exposed for a length of no less than 3,160 feet to the direct fire of the guns of ships between the high water and low water limit. Any breach or hole made in it below high water mark would, of course, admit the sea at the next tide to the whole interior of the tube. The trains in each tube will always pass through it in the same direction. The trains themselves will, consequently, act to some extent as ventilating pistons, forcing air out at one end of the tube and drawing it in at the other. By fitting wings to the engines or carriages, and throwing them out when necessary, the train may be made to fit the tube more nearly, so to speak, and thus to add to the efficiency of this source of ventilation. If other ventilation should be thought necessary—which was very doubtful if electric engines were used—one or more of the piers could be fitted up as a ventilating station, with steam engines, air pumps, etc., the foul air of the tubes being forced into suitable chambers, and thence by non-return valves into the sea."

CHIMNEY DRAFT.

The draft of a chimney is usually measured in inches of water. The arrangement most commonly made use of for this purpose consists of a U-shaped glass tube connected by rubber tubing, iron pipe or other arrangement, with some part of the chimney in such a way that the draft will produce a difference of level of water in the two legs of the bent glass tube. From a number of measurements made in this manner it is found that the intensity of draft in chimneys connected with boiler furnaces runs all the way from three-eighths of an inch to one inch of water, seldom getting above or below these figures. A draft equal to three-eighths of an inch is about as low as can be made of practical use in connection with boiler furnaces, while a draft reaching three-fourths of an inch is considered as being extremly strong, where no means is resorted to for producing a forced draft. But when we have the rated draft, says the *Stationary Engineer*, represented in inches of water, we have nothing definite for calculation, as the velocity of air and gases corresponding with such measurement is determined only at the expense of a number of experiments with delicate instruments, and such experiments necessary require considerable time. As the instruments for making tests of the velocity of flow of air or gases belong to a branch of science outside the engine room it is seldom that engineers meet with them or understand the method of working out the calculations from their record.

The anemometer used by the signal service consists of four hemispherical cups arranged at the ends of two horizontal crossed arms rotating about a center, gives a means of measuring the velocity of air, and is in daily use for measuring the velocity of the wind. The instrument is supplied with recording apparatus which records the speed and variation of the wind at all times during the day. Instruments of this kind are calibrated by moving them through the air at a known velocity on a calm day when no breeze is blowing. With an instrument of this kind correctly calibrated, the velocity of the gases in the chimney can be measured, but the instrument is not so practical for an engineer's purpose as the U-shaped tube, and when the velocity of flow compared with the difference in level of water and the efficient area of chimney are known, accurate calculations can be made as to the amount of air passing through the fire in the furnace. As the result of experiments, it has been shown that the actual velocity of air and gases due to one-half inch of water is equal to 32.5 feet per second, or 1,950 feet per minute. This would be at the rate of nearly 23 miles per hour. At three-fourths inch pressure the velocity is 41.1 feet per second or 2,466 feet per minute, being at the rate of about 26 miles per hour. With one inch pressure, the velocity per second is 47,5 feet or 2,850 per minute, giving a velocity equal to 32½ miles per hour, equaling a pretty strong wind.

These figure will enable a person to make calculations as to the volume of gases passing from the stack; but this does not give the amount of air passing through the fire, for when air of ordinary temperature, say 62° as an average, enters the furnace and becomes heated, its volume is considerably increased and the relative volume of the cold air and the heated gases must be known before the volume of air passing through the fire can be determined. Owing to the fact that air and gases expand by heat there must be a certain temperature in the stack which corresponds with the greater amount of air passing through the fire. This temperature has been found to be practically 552° above that of the external air, which would give with the air at 62° a temperature of 604°, or a temperature about equal to that of melting lead.

With the temperature of the gases at 600° the comparative volume of air admitted and gases which escape is in the proportion of, very nearly, two to one. That is, the gases which escape are of twice the volume of the air admitted to the fire. If the temperature in the stack is increased to as much as 1,100°, the volume of the gases is then three times as great as the volume of air which passed through the fire. So it will be seen that nothing whatever is gained by having a higher temperature in the stack, but on the other hand much heat is wasted in this way. Calculations can be made from the above data which will approximate, very closely, the amount of air supplied to the fire, but as there are many thing which combine to make this amount irregular, much closer approximations can be made by taking the strength of draft, according to the water measurement, from the ash pit, with ash-pit doors fitting reasonably tight, a small hole being provided in one of them for making the connection to the glass tube. Measurements can be made which are near enough correct for all practical purpose by simply closing the ash-pit doors occasionally, attaching the apparatus and noting the difference in level of the water and making use of the average of such measurements.

A draft guage attached to the stack at all times, although not considered a necessity, will be found of considerable use to the firemen who wishes to get the best results from the fuel burned; as such arrangement, after the average difference of level had once been obtained, would readily show at a glance the condition of the fire as to whether the fuel was evenly disposed on the surface of the grate or in other words, that the fire was of even thickness. It would also indicate too heavy a fire for best results, as well as the presence of a dirty fire, and the engineer who has such an arrangement attached to his boiler will find it of considerable service as being a check on the fireman to prevent careless and irregular firing, and besides, the saving effected by its use would many times more than pay the cost of attaching. It is all well enough to consider that so long as a boiler is making steam freely that it is all that is required, but so long as there is no practical or reliable means of knowing whether more coal is being used than necessary, the making of steam is not so economical as it might be. When an apparatus of this kind is attached to a stack it is shown to be quite sensitive, as the change in the draft by the opening or closing of the furnace door is instantly indicated by a change in the difference of level of the water in the two legs of the instrument. The occurrence of a hole in the fire is readily detected by the same means.

The apparatus is so simple that any engineer can make one for himself, as it consists simply of a glass tube bent into shape and connected to the stack. The glass tube may be easily bent by heating it in a gas flame and bending into the form required, the attachment to the stack can be made by a piece of rubber tubing or gas pipe. A paper scale arranged behind the glass may be made to show the difference of level in inches, or figures corresponding to the velocity of flow of the gases may be placed on the scale, and if it is made so that the height can be adjusted, it will not be necessary to keep the amount of water in the glass constant.—*Boston Journal of Commerce.*

The Oriental Consistory has appointed a committee to devise plans and a programme for the entertainment of all Scottish Rite Masons who shall attend the Exposition.

Commissioner Shufeldt has cabled from Cape Town, South Africa, that an exhibit of diamonds and feathers worth $300,000 will be sent from Cape Town.

CORRESPONDENCE.

Corliss and Slide Valve Engines.

To the Editor of the American Engineer:

Sir:—I see Old Slide Valve and Old Reliable still keep it up. But they don't give any information whatever concerning the most important point, and now we have an adviser to boot by the name of Peerman; but he is out of place in writing to a mechanical paper like this, he ought to be on the staff of some funny paper, does he not? No, if the hoop iron he speaks of was put on the cranium of the Recorder, the heat in the head would transmit it to the iron, expand the hoop, and allow the head to swell as much as it pleases; try again Mr. Peerman; also don't tell us that Old Slide Valve's real name is Flint. I know him too; his real name is—well, I won't give it away. But, please, Mr. Peerman, tell the truth; Old Slide Valve did say he could prove that 60 M. E. P. was an economical load; why don't he do it? Why don't he tell us the terminal pressure he got from the 60 M. E. P., and let the readers of this paper see for themselves. He said he asked for figures; I gave them; I did not say he had 1 inch clearance in the head, but I simply gave the port clearance, which he can not deny, and which a Corliss does not have. He did not tell us where he got that extra load on his engine, and how he saved coal over the other engines, and driving over 160 h. p. more than they did.

These are points I would like to see explained. He said he was not afraid to go into figures; that is just what we want; if there is anything to be learned we want to learn it. I gave my figures, and they have not been questioned. I see by his last article that he goes to his engine room on Sundays, as well as going to church; keep on Old Slide Valve, but be careful not to give yourself away; remember you went to church Sunday, did not go to fix your old gal, she was always ready. Old Reliable tells us he knows that the old slide is doing more work than the Corliss, because the place is twice as large as the other, and there is twice as much machinery. Fine engineering I must say, to put so large an engine in when one-half the size would do the work!

Please send on the cards, if you can get them. Now he goes off and tells us of the names of steamers that crossed the Atlantic with old slide valves, poppet valves, because it was before the Corliss valve was known. I would like to correct Old Slide Valve, and to say that there are Corliss valves on steamships crossing the Atlantic, and have been for years. One of our quickest tugs on the river is a Corliss valve, and they will all come to it after a while. Does Old Reliable know that all large engines in England had poppet valves at the time, and before any steamship crossed the Atlantic, and that the first poppet valve was made in England, when New York was a country town? It seems funny that they should be surprised at a valve gear that was in general use then. Both Old Slide Valve and Old Reliable know that our steamships are not all slide valve, and that the piston valve is fast taking the place of the slide valve on our fastest steamships to-day. That engine which Old Reliable speaks of at the rolling mill that did so well was not a slide valve, but a poppet valve. The engine they threw out was a slide valve, and if they had an engineer that understood the Corliss, there would not have been any trouble from that source.

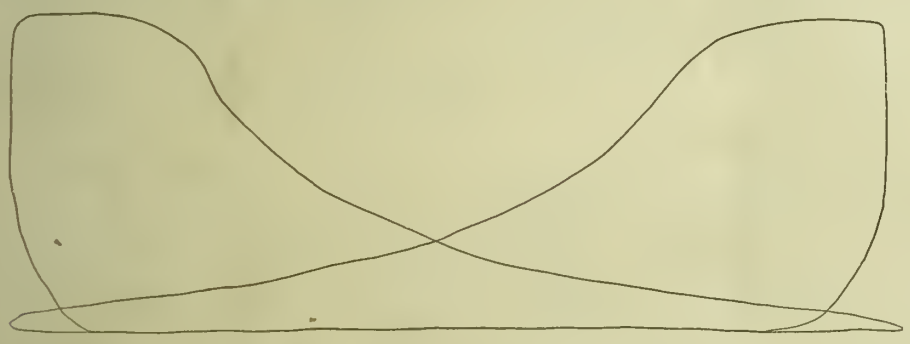
John Wood & Bro. of this vicinity, has an old spring lever Corliss in a rolling mill that has been in constant use for thirty-five years, night and day, and is doing good work to-day! They have simply got a man that knows how to run her.

Now, Mr. Editor, the whole sum and substance is that Old Slide Valve and Old Reliable will not come to the point. I have shown them the superiority of the Corliss valve over the old slide valve in plain figures, and they have never yet proven it otherwise.

Will Old Reliable send me the address of the confectionery and coffee mill proprietors that he speaks of, if I send the address of the firm in this city that put the Corliss cylinder on in place of the slide valve, and which I stated saved 50 per cent in the coal bill? Both addresses to be sent to The American Engineer, and then be sent to Old Reliable and myself by letter; or will he have to see the adviser first? No, Mr. Peerman, I do not think of telling blows at all, it is information I want, for myself as well as others, which I am sorry to say I have not received; and if they marry engines out in Omaha, we in Philadelphia marry ladies. Why don't you write to *Puck* or *Judge*, if you want to be funny; but if you write about engines, boilers or machinery, why, write to The American Engineer, of course.

Well, Old Slide Valve, you wanted a card. I will send you one, not the best by any means, but better than you can produce from your old gal with Judson governor. Now, here is the card, the figures you have had. I, for one, am waiting to be knocked silly! Boiler pressure, 105 lbs.; spring, 60; M. E. P. 36; total terminal 22.50=36; 59.50÷2=29.75 constant for the card $\frac{29.75\times22.50}{36}=18.59$ lbs. dry steam per h. p. per hour, or about 21 lbs. of water per hour. Then cards can be taken any hour in the day. You can see the load is most too light for best economy. Now, Old Slide Valve, when you come to this town again don't run off so soon, but come up and see me, and I will let you take the cards yourself, for we wont have to go far from my place to get them.

Recording Engineer,
Kensington No. 3, Pa.



Lake Washington and "Rockefeller's Scheme."

To the Editor of the American Engineer:

Sir:—I notice in the American Engineer of Sept. 12, 1891, an article entitled "J. D. Rockefeller's Scheme," which contains some great inaccuracies. I am thoroughly familiar, by daily personal examination covering a period of a number of months, with Lake Washington and the country between it and Puget Sound. I am also thoroughly familiar with the Belt Line Railway referred to, having been connected with the engineering corps of the same. So far as engineering problems go there is nothing whatever connected with the entire work at all stupendous or of special interest excepting the crossing of Mercer Slough by the Belt line. Mercer Slough is an arm of Lake Washington which has been filled with a boggy material, which makes the building of the road a difficult matter. It is 1,500 feet wide where crossed, and the sounding rod indicated depths of from 40 feet to 90 feet for this soft material. All piles for bridge work in the center were not less than 100 feet long and driven to project only from 3 to 6 feet.

Lake Washington is 22 miles long with an average width of about a mile and a maximum of about one and a half miles. At one end is Mercer Island about five miles long and a mile wide. It is spring-fed, and is used as the source of water supply for the city of Seattle (population 50,000) which lies between it and Puget Sound, which at this point is only 2½ miles distant. Its elevation above the Sound is about 25 feet. From deep water in Lake Washington to deep water in Puget Sound is about five miles, the greater part of this distance though is through Salmon Bay, an estuary of the Sound, Lake Union and Union Bay of Lake Washington. Through Salmon Bay and Union Bay there would be some dredging in soft mud to do. A canal with from 3 to 4 feet of water is already dug from Lake Washington to Lake Union and from thence to Salmon Bay and the Sound. Between Union Bay of Lake Washington, and Lake Union is a quarter of a mile with a maximum elevation of 40 feet; material a sandy and gravelly earth. From Lake Union to Salmon Bay is about a mile of level land. This is the old natural outlet of Lake Union, and the excavation necessary would practically be that due to the depth of water in the canal.

Lake Washington, which forms one boundary of the city of Seattle, has 72 miles of water front and at very few points on the lake, but a wharf from 200 to 300 feet will reach a depth of water sufficient to float the largest vessel afloat. It has a depth of several hundred feet reaching I think about 900 feet as the maximum. The last session of congress appropriated $10,000 for the survey of the line from the Sound to Lake Washington and to Lake Sammamish, a lake about eight miles long and 1½ miles wide, tributary to Lake Washington and about 20 feet above it. The figures I have given are as given by the government engineers. Lake Union, which is on the line of the canal, is entirely within the city limits of Seattle, is of ample depth for any vessel built, and has probably 6 or 7 miles of shore line. As will be seen from all this the project of the canal is entirely feasible and will cost but little. Salt waters here are infested with the teredo which frequently requires entire renewals of piles inside of 18 months. The extra expenses on this score during 25 years would probably build the canal. The request that congress appropriate the money necessary for this work, in view of its case and the benefits to be derived, seems reasonable. That the future metropolis of the Pacific coast north of San Francisco will be here, or near, none can doubt who is acquainted with the country, while with many not even San Francisco is excepted. The State of Washington has more coal than Pennsylvania, more iron than either Pennsylvania or Alabama, more and better timber than both Michigan and Wisconsin ever had, unrivalled harbors, gold and silver in enormous quantities, the extent of which is only beginning to be guessed at, marvelous fertility in agricultural products, and in the western half at least a very mild climate ranging from 10° to 85°. Those who may doubt any of this I would refer to the U. S. census reports.

Yours truly,
H. L. Reynolds.

"Good of the Order."

To Jefferson Young, Jr., Sup. Chf. Engr.:

Dear Bro.—Your letter of the 15th at hand, and while I read your statement, which deeply concerns *our* undivided interests in the Order, I must say the boys are a little too fast. My summer has been one of vacation, in fact I have just returned after a week "in Canada" and while I like to be fair and just, any brother of the A. O. of S. E. that forgets himself so far as to think working engineers must devote all of their time to giving details and publishing statements when their confidence should be strong and sound after the convention of their choice had passed measures for their personal benefit, and I only hope they will be as prompt when I call for their assessment.

The medical certificates are now ready and a note has been sent for The American Engineer to publish that all councils send their orders to me. I will enclose one to you. I am willing to work for the Order, but the boys must remember that my regular business takes part of my time and that through the summer I am away a good part of the time, also that for them to show a spirit of want of confidence in the work, and its officers show a want of intelligence that I never gave them credit for, and you can read this letter to them if you wish or publish it. Glad to meet you in Boston and feel no little surprise at what you write.

I send to-night the last of constitution to paper. Will write you more fully later. Yours truly,

Chas. E. Jacks.

The people in the far North eat candles when they can get them. This is one way of making a light meal.

ELECTRIC HAULAGE AT A WELSH COLLIERY.

The first installation of electric mining machinery in the South Wales coal fields has recently been made by Messrs. Crompton & Co., of Chelmsford, England, at the Abercanaid colliery of the Hill's Plymouth Company, being an electrical haulage plant designed to replace 27 horses, and many hauliers and door-boys, and to enable the output of the colliery to be increased by 100 tons per day says the *Engineering and Mining Journal*. The winding gear adopted in this plant is of the usual form employed in the main and tail rope system. The motor is a Crompton series-wound machine, arranged to run at 600 revolutions per minute and take 80 amperes at 450 volts. The motor is placed horizontally at one end of a wrought-iron frame, which forms the bed for the winding drum and spur wheel. The drum shaft, which is of steel, is driven from a countershaft by means of spur gearing, and the motor drives the countershaft by means of six 1-inch ropes. The haulage engine is fitted with two drums, 3 ft. 6 in. diameter and 1 ft. wide, which are controlled by a clutch and foot brake.

This plant will haul coal from three different parts of the pit, and although these are not at the present far from the motor, it is expected that coal will have to be dealt with nearly a mile distant. The generating plant comprises a Crompton dynamo, horizontal pattern, fixed on a wrought-iron bedplate. It is compound wound, and will give out 160 amperes at 500 volts, running at 550 revolutions. The cable connecting the dynamo with the haulage plant is 3,200 yards long, and composed of 37-strand No. 14 high conductivity copper wire, highly insulated with vulcanized bitumen, double taped, and served with two layers of jute yarn, compounded between each. It is protected by a double sheath of No. 8 steel wire, the first stranding being of 30 wires, and the second 36 wires laid in reverse directions. The current density is 870 amperes per square inch, and resistance of cable 3192 ohms, allowing a loss of potential of 51 volts, or 10 per cent. From the generating plant the cable is carried down the side of the shaft, and between the hauling engines it is fixed on each side of the roadway. To meet the case of "falls" the cable has been constructed so that it can stand a shearing stress of 10 tons per square inch.

TWO MILES A MINUTE.

The latest announcement anent "rapid transit" appears in the Springfield (Mass.) *Republican*, which says:

Belanger's flying bicycle, and all other forms of speedy locomotion, seem likely to be eclipsed by the invention a Springfield man has completed, which he thinks can bring Boston within an hour's ride of this city. The device is that of an elevated electric railway, on which his theory has demonstrated that two miles a minute can be made. The cars are propelled along a high trestle-work following the ground surface, as there is little to intimidate the fickle force even in a steep grade. A great saving would be made in this way, for no road-bed, proper, would be necessitated. Two rows of spiles driven into the ground serve to hold the iron supporting columns, hollow at the base. Arches placed lengthwise from post to post, and swelling overhead between each pair of posts, secure the rigidity of the frame work. High up at the top of the columns the track is placed, the rails of which are attached to the posts on either side. As there is no direct connection between the rails it would be impossible for either man or beast to walk along the track and get ground up. One wheel on each axle of the car truck is so fastened as to play with extra ease, curves can be rounded without trouble, while a horizontal wheel running along beneath a stout lip on the track, would prevent any possibility of a tip-over. The wooden shell of the car, resting upon rubber springs, would be held in place by an iron framework, so braced as to escape practically all motion except that upward and downward upon its springs. From the power supplied, lights are scattered aloug on each overhead arch and the cars lighted as well, not to mention the possibilities of localities adjacent, through which the road might pass. The location of cars can be determined by electrical signals remaining at danger for a certain length of time after a train has passed, similar to the union block signals now in general use on railroads. Built upon trestle-work, no culverts or dry bridges would be necessary. The model is soon to be put in actual operation by a small dynamo made for the purpose.

THE FIRST IRON BRIDGE.

At the present day, when we are accustomed to look upon iron as the chief constructive material with which civil engineers and architects all over the world deal, the first iron bridge that was ever built is a curious sight, observes the Baltimore *Sun*. This bridge, the arches of which were made of iron, was called "Ironbridge," and it was erected in 1778. It spans a little river in the county of Salop, on the railroad line from Shrewsbury to Worcester, in England. At the present day the structure is surrounded by a thriving little village, which took the name from the bridge. Several iron foundries have been established in the neighborhood. The structure was a timid attempt at what has since developed into an extensive industry. There are three supports; two of them are very small and cross a narrow country road, while the third and largest one spans the bed of the river, It is about ninety-six feet long and weighs 378 tons.

The braces were cast at Coalbrookdale, every bar being composed of two segments. Stephenson, the great engineer, wrote as follows on the construction of this first iron bridge: "When we bear in mind that the manipulation of cast iron was at the time of its erection in its infancy, we cannot help but feel convinced that unblushing audacity alone could conceive of such an enterprise, and the intelligence with which the details were outlined and executed is equal to the boldness of the conception." The bridge is constantly used and is in excellent condition, a fact which disproves all the ominous clamorings of cranks that the pernicious influence of rust will sooner or later bring danger to the iron bridge of to-day.

INTERPRETING A DREAM.

There is quite a sermon in this one, told me by an old Scotchman who happened to be seated in the same carriage with me. A Dundee navvy, on awakening one morning, told his wife of a curious dream that he had during the night. He dreamed that he saw a big fat rat coming toward him followed by two lean ones, and in the rear one blind one. He was greatly worried over it, and swore that some great evil was about to fall upon him. He had heard that to dream of rats forebode some dire calamity. In vain did he appeal to his wife, but she could not relieve him. His son, who, by the way, was a bright lad, hearing the dream told, volunteered to interpret it, and he did in all the wisdom of a Joseph. Said he: "The fat rat is the mon who keeps the public house where ye gang to sae aften, and the twa lean are me and me mither, and the blind one is yersel', father."—*From "England Through Yankee Eyes."*

AFTER ROCKY MOUNTAIN SHEEP—THE HUNTER HUNTED.

In the pursuit of Rocky Mountain sheep the hunter, to be successful, must have a fondness for the mountains, a sure foot, good wind, and a head which no height will turn. These requisites, with patience and perseverance, will sooner or later, as the hunter gains experience, reward him with ample returns. Sometimes, however, the unexpected will happen, and the following tale will serve as an example. We were camping well up in the mountains, and almost any hour of the day sheep could be seen with the glasses.

There were two fine rams in particular that we could see about a mile and a half from camp, occupying the slope of a rocky point or promontory that jutted out from a spur of the range.

With due care, and not making a sound, I made a most successful stalk. Peering over the ledge I just raised my head enough to be sure my game was still there. They were there sure enough, within seventy-five yards of me totally unconscious of danger, when all of a sudden they sprang to their feet and dashed away from below me as though possessed of a devil. I fired hastily, but of course missed, and turning tried to run back to head them off, wondering what had started them, as I knew I had made no noise. In a few seconds I had the mortification of seeing my would-be victims bounding across the narrow ledge that separated them from the mountain. However, I thought with satisfaction that at least one would meet its death from my companion in hiding, but, alas! although the rams almost knocked him down, his cartridge missed fire.

Regaining my shoes, I soon joined my companion and thon discovered the curious adventure I had been made the subject of. It seems that when I had reached a point well down on the promontory, I must have disturbed a cougar which was evidently there for the same purpose that I was, and which had stealthily followed me as I proceeded toward the sheep. Old Woody described it as highly amusing—I sneaking down after the rams, and the panther sneaking down upon me.—From "Hunting American Big Game," by Archibald Rogers, in October *Scribner*.

ORIGIN OF THE SONS OF VETERANS.

The order of the Sons of Veterans, says *Frank Leslie's Weekly*, was organized in 1881 by Major A P. Davis, or "Father Davis," as the boys love to call him. Major Davis is a resident of Pittsburg, Pa. He is a man in whom the military spirit has ever burned brightly. He was born in Gardiner, Me., in 1835. In 1849 he sailed to California in search of the gold which was the magnet of so many lives. When the Crimean war broke out he enlisted as a subordinate officer in the French naval service, in which he remained to the close of the war. When the war of the Rebellion broke out he enlisted in one of the first regiments raised in the State of Main. He rose from the ranks until, in 1865, he was given the rank of major, and was mustered out as such. He has endeared himself to the members of the order, as has good wife, who his known among the Sons of Veterans as "Mother" Davis.

AN ALLOY OF COPPER AND ANTIMONY.

In the proportion of 100 to 6 such an alloy is made by Mr. T. Held, an American, by melting the copper and subsequently adding the antimony, and, when both are melted and intimately mixed, fluxing the mass in the crucible, with an addition of wood ashes, magnesium, and carbonate of lime, which has the effect of removing porosity and increasing the density of the metal when cast. The alloy can be rolled, forged and soldered in the same manner as gold, which it very closely resembles when polished, the gold color being unchanged, even after long exposure to ammonia and acid vapors in the atmosphere. The cost of the alloy in the ingot is stated at about 25 cents per pound.

THEY ARE COMING THIS WAY.

It is reported that R. C. Jenkins, one of the largest Welsh tinplate manufacturers, has about decided to give up the work in South Wales, where he is at present, and come to America. His mills in Wales have an output of 4,200 boxes per day, but he has received advantageous offers to locate in the United States and has about concluded to locate at Joliet, Ill., where 25 acres of land are offered him gratuitously. It is also said that William Williams, the "tinplate king" of Wales, and his son-in-law, W. H. Edwards, are also seriously considering the advisability of coming to the United States.

Two anchors that Columbus carried in his ships will be exhibited at the Fair and already one of them is stored in Washington, waiting to be brought to Chicago. The anchors were found by Columbian Commissioner Ober near two old wells at San Salvador. He had photographs and accurate models made. These reproductions were sent to Paris, where expert antiquarians pronounced them to be fifteenth century anchors, and undoubtedly those lost by Columbus in his wreck off San Salvador. One of them has been presented to the United States and the other will be loaned to the Fair.

WORLD'S FAIR NOTES.

It is probable that the five territories—New Mexico, Utah, Arizona, Oklahoma, and Alaska—will make their exhibit of their resources and products under one roof. They united in a request to that effect and it was granted. Utah, however, wants to make an exhibit by herself if her legislature appropriates enough money to enable her to do so.

The Executive Committee of the Illinois Woman's Alliance has asked for the privilege of making a display at the Fair which will show the evil results of child labor.

Wm. Stiassny, of Paris, has protested against being called a swindler. He says he has not sold any agencies of the Exposition, as reported, and that he is simply acting in good faith and in a legitimate way as the head of a company whose object is to secure and care for exhibits for the Fair.

Secretary Dickinson is greatly interested in the efforts of Texas, his own State, to raise a large Exposition fund. He has offered prizes of $100, $75 and $50 to the young woman of Texas who shall raise the largest amount for the fund before November 1st.

The Grounds and Buildings Committee decided to advertise for the construction of a building to accommodate four sawmill plants. The structure will be located south of the Agricultural Annex, on piles driven in what is now a natural lagoon. The building will be 130x200 feet and will cost $25,000.

Senor Novez, of Madrid, petitioned for the privilege of conducting bull fights during the Exposition, and offered to pay $1,250.00 for the right to do so. The directory decided not to sanction any bull fights.

Two granite columns for the Woman's Building have been contributed by Mrs. Alice Houghton, Lady Manager, of Washington. The columns are fifteen feet high, twenty inches in diameter, and will be placed in the main entrance on the east side of the Woman's Building.

Half a million pansies, one hundred thousand roses, and millions of other flowers, including every known variety and species, will be seen at the Exposition. The horticultural exhibit will be on a scale never before attempted in the history of the world. Mr. Thorp, of the floriculture division, estimates that the equipment of the horticultural building, including the purchase price of plants, will be $350,000, and the total expense of the display $750,000. The floriculturists of the country will donate a large share of the plants. Ten of the sixteen acres of ground on the wooded island will be planted in flowers. The shores of the island will be left wild for scenic effect, and the water around the margin of the island will be bright with water lilies and other aquatic vegetation, while the interior of the island will be planted with roses, rhododendrons, and lilies, besides a vast variety of wild flowers, which are at present preserved in a nursery on the island.

The Brazilian Government intends to make a magnificent display at the Exposition and will invest not less than half a million dollars in carrying out the plans for its representation. It is proposed not only to erect a building in which to display the magnificent resources of Brazil, but to surround that building with practical illustrations of the methods of agriculture and industry. There will be a sugar mill in operation, a coffee quinta, at which the method of gathering and curing coffee for the market will be illustrated, and the manner in which rubber is gathered and prepared for market will be shown in a similar way. There will be also several fac-similes of native huts, with native families living as they live at home, and pursuing their industries. It is proposed also to have the national band of Brazil in attendance.

Many people in Mexico are already making active preparations to attend the World's Fair, and are joining tourists' clubs. The most popular scheme thus far presented is one proposed by Senor Spindola, who will conduct a great number of excursions from Mexico to Chicago and return. The cost to each subscriber will be $260 (Mexican), and will include all the necessary expenses of the trip, viz: railway fare to and from Chicago, Pullman car service, meals en route, ten days hotel in Chicago, ten admissions to the Exposition, and street railway tickets covering the entire period of the stay in Chicago. Other excursions on a like plan are proposed by sea, both from the east and west coast, to New York and San Francisco, thence to Chicago by rail. Each party will be accompanied by competent interpreters, and the different plans are being most favorably commented upon by almost the entire press of Mexico.

Rudolph Cronau, the eminent author and scientist of Leipsic, Germany, has tendered to the Exposition his extensive collection of paintings, sketches, and photographs, representing scenes in the life of Columbus and places visited by Columbus during his voyages to the new world. Doctor Cronau has spent a great part of his life in the study of early American history, and has published a work on the subject, based entirely upon his personal investigations.

Special Treasury Agent, General Grosvenor is meeting with success in enrolling Irish exhibits for the Chicago Fair. Merchants of Dublin, Belfast, Cork, and Waterford are seconding his efforts, and a fine display from Ireland is promised. Lord and Lady Aberdeen are also deeply interested and actively working to secure the same end.

There is to be a Columbian Exposition at Madrid, Spain, during the summer of 1892, and the Exposition management is endeavoring to profit by it and secure exhibitors for the Chicago Exposition in 1893. Chief Fearn, of the Department of Foreign Affairs, is preparing a circular which will be sent out to all the exhibitors at the Madrid exhibition; advising them that while they are making a display at that Fair, they might as well prepare also for the Columbian Exposition at Chicago.

Dr. West, a collector of curios at Antigonish, Nova Scotia, is entitled to the credit of having shipped to the Columbian Exposition the first exhibit from a foreign country. The goods came through the Custom House a few days ago, and consisted of useful and ornamental articles purchased from the Antigonish Mountain Indians. There were a stone hatchet, a stone pipe, two wigwams, a porcupine quill box, an iron spear, an Indian game plate, two pairs of moccasins, an Indian jacket and head-dress, several knives, a moss book, and a wooden fan. The whole outfit was invoiced at $20, the duty on which is $7. The goods were placed in bond.

The Colorado Marble and Mining Company has offered to donate sufficient marble to erect the Colorado State building at the World's Fair. The only conditions the company makes are that its members shall be consulted with reference to the construction of the building, so that the effect and beauty of the marble can be brought out to the best advantage, and that the State pay the railroad freight on the material from Colorado to Chicago. It is claimed that in durabilily, tone, color and finish the Colorado marble is equal to any imported from Italy.

E. T. Jeffrey, Chairman of the Grounds and Buildings Committee of the Exposition, made the following estimate of necessary Exposition expenses for submission to the recent meeting of the National Commission:

Buildings	$ 7,295,000
Grading and filling	450,000
Landscape	323,490
Viaducts and bridges	125,000
Piers	70,000
Waterway improvements	225,000
Water supply and sewerage	600,000
Railways	500,000
Steam plant	800,000
Electricity	1,500,000
Statuary on buildings	100,000
Vases, lamps, and posts	50,000
Fuel and light during construction	20,000
Seating	8,000
World's Congress	200,000
Improvement of lake front	200,000
Gencral expenses of Construction Department	500,000
Organization and administration	3,308,563
Police, watchmen, and other expenses	1,550,000
Total	$17,825,453

Farmers, Farmers' Alliances, and other rural organizations will be provided for in a special building at the World's Fair. It is intended that the farmers shall have nothing of which to complain in regard to their reception and treatment by the World's Fair management. They will be afforded quarters in the Live-Stock Assembly Hall, plans for which have just been completed. The building will stand south of the colonnade connecting the Agricultural and Machinery Buildings in the south end of the park.

On the front floor will be office-room for cattle and horse associations, dog and pet stock associations, and all remaining live-stock organizations. On the second floor will be an assembly hall 172 feet long and 74 feet wide. Here the farmers will be given a chance to hold meetings. Special rooms are provided for the Farmers' Alliance, the National Grange, and similar associations. The entire structure has been so planned as to give the farmers and live-stock men generally all they could ask in the way of accommodations at the World's Fair. The building will, in form, resemble the letter T, one portion being 500 feet long, and the other 200 feet.

ELECTRICAL SCIENCE PROGRESSING.

Discoursing upon the progress of the electro-magnetic science Prof. Arthur E. Kennelly observes that the following facts seem to have been fully established: First—In electro-magnetic science the great achievement since Faraday's time has been the determination that all electricity flows, or tends to, in close curves or circuits, so that we have the electrostatic circuit, the galvanic circuit, and the magnetic circuit, each resembling, as it were, an endless chain or a bundle of endless chains; and the laws which control these three different types of circuit show wonderful analogies. Second—The due appreciation of the influence of the ether and its importance in all electro-magnetic phenomena. While originally the electrical activity seemed to be confined to the battery or conducting wires of a galvanic circuit, it is now believed that the ether surrounding these conductors plays fully as active a part in the process of conduction; and the mind sees free space no longer void, but filled with an active and responsive substance—the ether. It looks almost as if matter were inert in comparisonwith the ether which surrounds it. Third—The evidence in favor of the proposition that light is a vibratory disturbance in the ether of an electro-magnetic nature is such as almost to amount to demonstration. When this shall be generally accepted, the whole domain of optics and radiant energy will be enrolled as one department and property of electro-magnetic physics.

Light, although seemingly so unsubstantial and powerless, is labor, and requires force to generate it as much as wood-chopping or verse-making. Early ray of light that vibrates in space is as full of force and energy as the ax of the wood-cutter in its swing. Every ray that comes to us is the product of chemical labor applied to distant stars by elements such as oxygen, carbonic acid, etc., in the fierce tumult of chemical union and decomposition. Even to this day, savages generate fire by the sweat of their brow through the rapid continuous friction of two bits of wood. The day will assuredly come in which electricity will be generated directly from the heat of burning coal without the intervention of steam or dynamos; something has, indeed, been already achieved in this direction.

SITUATION WANTED

As engineer, by a thoroughly experienced and reliable man, highly recommended. Address "Steam," care of The American Engineer, 1302 Pontiac Building, 358 Dearborn street, Chicago.

LITERARY.

The Master Car Builders' Association have issued their report of proeeedings of their 25th annual convention held at Cape May, N. J., June 9, 10 and 11 last. It is a thick volume and conveniently indexed, with numerous valuable diagrams.

Zwicker's Revised Practical Instructor has been reissued by Walter G. Kraft, Chicago, whose advertisement (containing a strong endorsement of this simple and comprehensive book) appears in this issue. Zwicker's oontains most valuable information for engineers and others in plain language, without mensuration or algebraical equations. Concerning an attack recently made on this book, *The Safety Valve* says:

"The president and general manager of a company which publishes a journal alleged to be in the interest of steam engineers openly charges with imposture the author of a book designed to aid engineers to pass their examinations. He does not allege that the book contains inaccurate information, but that it aids those having only a theoretical knowledge to obtain licenses as practical engineers. For our part, we do not believe that a man without engine-room experience could pass an honest board of examiners by the aid of any book of instruction. Moreover, we don't believe he who makes the charge can instance a single *bona fide* case of the kind. He seems to be impelled to the attack by maliciousness or self-interest, and cackles over his pretended discovery like a hen that has just laid an egg.

"Perhaps he will belay his yawp when he discovers the egg is rotten.

"The author might with equal justice claim that the organ conducted by his accuser is calculated to do engineers more harm than good, inculcating vicious ideas and dealing in preposterous philosophy; that, because of this he is an impostor and should be suppressed.

"We don't pretend to know the man accused, but we once had a transaction with his accuser, and since then do not credit his charges or believe his promises."

The Institution of Civil Engineers, London, have issued their annual journal for 1891, which consists of their charter, supplemental charter, by-laws, and list of members. It is a most valuable book of reference for civil engineers.

"Coinage of gold and silver" is the subject of a pamphlet issued by the House of Representatives side of Congress. It opens with Mr. Wickham's "adverse report," which is followed by Mr. Bartine's "views of the minority." Tho views of other prominent men follow. Altogether the pamphlet contains much matter of great value to those specially interested in the coinage of gold and silver. Politicians will find it a useful book of references.

The Illinois Statesman is the name of the latest arrival in the field of political literature. Vol. 1, No. 1, holds forth "Gresham a Possibility," with a cartoon of Carter H. Harrison in the background. "Our Carter" is made to say: "I'm going to be the World's Fair Mayor of Chicago or re-elect Mr. Washburne. I'm the only Democrat that is fit to hold the office, etc. Those interested in Illinois politics will find to this publication lively reading. No. 1 is also full of good photos.

The Prospectus and Journal of the Brotherhood of Electrical Mechanics for 1891 (their first number), has just been issued. The aims and objects of the Brotherhood (whose head office is at 94 Dearborn St., Chicago), are:

To establish in all large cities of this country a meeting place for the members of the Brotherhood of Electrical Mechanics; that meeting place to be supplied with as much experimental apparatus as they can afford to purchase. In connection with this they aim to accumulate an electrical library, also, to keep on file the best electrical papers and magazines and all available scientific literature.

Their object is to secure for themselves that technical education, the need of which they feel in their daily work, knowing that by securing this technical knowledge they can raise the standard of excellence among their members, and thereby make themselves more valuable, and consequently will command better wages. They believe that "*Knowledge is Power*," and that this is the correct solution of the labor question.

They have also for an object the care of the sick or disabled members, the burial of dead members, and the securing of positions for members who are unemployed.

The Brotherhood is not a labor organization in the general acceptance of the term. They leave the question of wages where they think it properly belongs, that is, between employer and employee. They are unequivocally opposed to strikes, and to anything that will interfere between employer and employees, as they believe their interests to be identical.

Scribner's Magazine for October is led by the fourth article in the series on "Great Streets of the World." Mr. W. W. Story, the eminent American sculptor and writer, who has spent the most of his life in that city, writes of "The Corso of Rome," recalling its mediæval glories, and giving many personal reminiscences of his sojourn there, with picturesque descriptions of the street as it exists at the present day, its palaces, monuments, churches, and public buildings, and a vivid account of the Carnival in its gayest days—the races of the Barberi and the closing night, when thousands of wax tapers are lighted and carried about the street. The illustrations for this article are by Ettore Tito, a Roman artist, who has caught the spirit of this most historic street. There are also several very entertaining out-of-door articles—Archibald Roger's adventures in "Hunting American Big Game," and with it Dr. J. N. Hall's short paper on the "Actions of Wounded Animals," which sportsmen will find of very practical interest; Edward L. Wilson's "Biography of the Oyster," from the planting of the seed to the market; and Major J. W. Powell's account of the origin and probable effects of the new lake in the Colorado Desert. The fiction of this issue includes a long and amusing instalment of "The Wrecker," by Robert Louis Stevenson and Lloyd Osbourne; a detective story, "Captain Black," by Charles E. Carryl; and a tale of the classic days of Greece and Rome by Dr. Ernst Schottky, a German resident of New York, who originally wrote this tale in his mother tongue. A paper on "Carlyle's Politics" as revealed in his essays—with poems and the Point of View—completes a strong number.

BUSINESS TRANSACTIONS.

The Hoppes Manufacturing Co., through their Minneapolis office (of which Mr. E. Webster is manager), have made the following sales during the latter part of the past month:—John Morrell & Co. (Limited), Ottumwa, Ia., 500 h.p. purifier and 400 h. p. exhaust heater; Minnesota Hospital for Insane, St. Peter, Minn., 200 h. p. exhaust heater.

The Lidgerwood Manufacturing Company, with headquarters at 96 Liberty Street, New York City, have established a branch house in St. Louis for the sale of their standard hoisting engines, at 610 North 4th street, and 609 North 3rd street, under the management of Mr. Chas. W. Melcher, a gentleman of well-known ability and enterprise.

The Lidgerwood Manufacturing Company is one of the busiest and most prosperous concerns in the United States, and have sold over 8,000 of their famous engines.

Map of the United States.

A large, handsome map of the United States, mounted and suitable for office or home use, is issued by the Burlington route. Copies will be mailed to any address on receipt of 12 cents in postage by P. S. Eustis, Gen'l Pass. Agent, C., B. & Q. R. R., Chicago, Ill.

NEW! NEW!

FOR MANUFACTURERS.

Who wants to buy a small new machine for imitation and exploration in America. Sole machine in the world of first necessity for manufacturers of chocolate, and patented only in Europe. Please address offers, if possible in German, to C. N. 27850, care Rudolf Mosse, Berlin, S. W. (Germany).

CHICAGO, MILWAUKEE & ST. PAUL RAILWAY.

Electric Lighted and Steam Heated Vestibuled Trains, with Westinghouse Air Signals, between Chicago, St. Paul and Minneapolis, daily.

Electric Lighted and Steam Heated Vestibuled Trains between Chicago, Council Bluffs and Omaha, daily.

Through Vestibuled Sleeping Cars, daily, between Chicago, Butte, Tacoma, Seattle, and Portland, Ore.

Solid Trains between Chicago and principal points in Northern Wisconsin and the Peninsula of Michigan.

Daily Trains between St. Paul, Minneapolis and Kansas City via the Hedrick Route.

Through Sleeping Cars, daily, between St. Louis, St. Paul and Minneapolis.

The finest Dining Cars in the World.

The best Sleeping Cars. Electric Reading Lamps in Berths.

6,100 miles of road in Illinois, Wisconsin, Northern Michigan, Iowa, Minnesota, Missouri, South Dakota and North Dakota.

Everything First-Class.

First-Class People patronize First-Class Lines.

Ticket Agents everywhere sell Tickets over the Chicago, Milwaukee and St. Paul Railway.

CONTRACTS OPEN.

United States Engineer Office, 34 West Congress street, Detroit, Mich., September 19, 1891. Sealed proposals, in triplicate, will be received at this office until 2 o'clock p. m., October 19, 1891, and then opened: For furnishing ten gate anchorages for the 800 feet lock at St. Mary's Falls Canal, Michigan. Preference will be given to materials of domestic production or manufacture, conditions of quality and price (import duties included) being equal. Attention is invited to Acts of Congress, approved February 26, 1885, and February 23, 1887, vol. 23, page 332, and vol. 24, page 414, Statutes at Large. The government reserves the right to reject any or all proposals; also, to waive any informalities. For further information apply at this office. O. M. Poe, Colonel Corps of Engineers, Bvt. Brig. General, U. S. A.

Heating and Ventilating Apparatus.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock p.m. on the 12th day of October, 1891, for all the labor and materials required for putting in place complete the new low pressure, return circulation steam heating and ventilating apparatus for the U. S. Courthouse and Post Office Building at Portland, Me., in accordance with drawings and specifications, copies of which may be had at this office or the office of the custodian of the building at Portland, Me.

Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal.

The department will reject all bids received after the time herein stated for opening the same; also bids which do not comply strictly with all the requirements and meaning of this invitation.

Proposals must be inclosed in envelopes, sealed and marked "Proposals for the New Low Pressure, Return Circulation Steam Heating and Ventilating Apparatus for the U. S. Courthouse and Post Office Building, at Portland, Me.," and addressed to W. J. Edbrooke, Supervising Architect.

Building Materials.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until the 9th day of October, 1891, for all the labor and materials required for the excavation, concrete foundations, stone and brick work, iron and wood floor and roof construction, roof covering, etc., of the U. S. Post Office building at Jackson, Mich., in accordance with the drawings and specifications, copies of which may be had at this office. Each proposal must be accompanied by a certified check for not less than 2 per cent. of the amount of proposal. Proposals must be sealed and marked "Proposals for Excavation, Concrete Foundations, Stone and Brick Work, Iron and Wood Floor and Roof Construction, Roof Covering, etc., for the U. S. Post Office Building at Jackson, Mich.," and addressed to W. J. Edbrooke, Supervising Architect.

Steam Heating and Ventilating Apparatus.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until the 9th day of October, 1891, for all the labor and materials required for putting in place complete the low pressure, return circulation, steam heating and ventilating apparatus for the United States Post Office building at Kalamazoo, Mich., in accordance with drawings and specifications, copies of which may be had at this office. Bids will also be considered for any other system of heating and ventilating in lieu of the above, and parties proposing to supply such must submit, with their proposal, plans and full specification for same. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal. Proposals must be inclosed in envelopes, sealed and marked, "Proposals for the Low Pressure, Return Circulation, Steam Heating and Ventilating Apparatus (or otherwise, as the case may be) for the United States Post Office building at Kalamazoo, Mich.," and addressed to W. J. Edbrooke, Supervising Architect.

Steam Heating and Ventilating Apparatus.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until the 6th day of October, 1891, for all the labor and materials required and fixing in place complete the low pressure, return circulation, steam heating and ventilating apparatus, power boiler, pump, etc., in the United States Custom House, etc., building at Galveston, Texas, in accordance with the drawings and specifications, copies of which may be had on application at this office. Bids will also be considered for any other system of heating and ventilating in lieu of the above, and parties proposing to supply such must submit with their proposal plans and full specification for same. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal. Proposals must be sealed and marked, "Proposals for the Low Pressure, Return Circulation, Steam Heating and Ventilating Apparatus (or otherwise, as the case may be), Power Boiler, Pump, etc., for the United States Custom House etc., building at Galveston, Texas," and addressed to W. J. Edbrooke, Supervising Architect.

An Opening.—A chief engineer of three years' experience in southwest Virginia, east Tennessee and North Carolina would like to meet one or two bright men with $100.000 each who could complete 15 miles of railroad on which $60,000 cash has been expended for grading this season. The present company are local men who have run out of cash, but the project is as good as ever, and the opportunity now occurs to take advantage of their misfortune. No debts are owing, no bonds have been issued, and about $150,000 of local bonuses are promised. The inducements to take hold are: when built this railroad will inevitably be required by the projected extension of a present large system; it will pay handsomely from the start; and, best of all, large mineral and timber properties can now be secured cheaply, whose value would be greatly increased by the completion of this railroad.

I have no money and no financial connections, but have this opportunity and can give the highest professional references. Address Chief Engineer, P. O. Box 360, Bristol, Tenn.

OCTOBER 10, 1891. The American Engineer. VOL. 22, NO. 15.

CURTIS TANK GOVERNOR AND PUMP

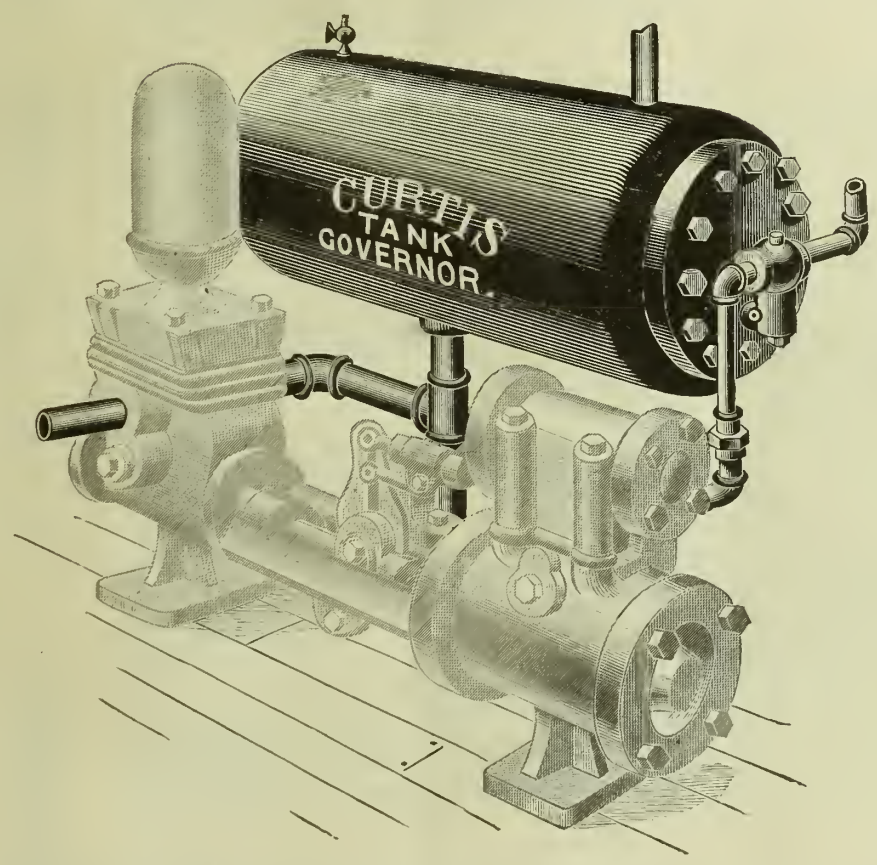
The accompanying illustration shows the Curtis tank governor and pump combined. It is one of Mr. Curtis' new patents, and he and others believe that it is destined to have a great sale.

The device forms a very compact and effective combination of receiver and boiler feed pump, all piped together and ready for service, by means of which the returns from any system of heating or drying in which steam is condensed are automatically and regularly returned into the boiler against any pressure that may be therein, and at the highest possible temperature. This applies to steam coils, radiators, steam jackets, drying cylinders, slashers, lumber dryers, canneries, brick kilns, etc. In addition to a steam pump of the best make the apparatus includes a closed tank into which the returns are brought by gravity.

To the removable head of the tank is attached a frictionless balanced steam valve, operated by a hollow float and lever on the inside. The float is so arranged in connection with the valve that it maintains a constant water line in the tank, speeding or retarding the pump in exact relation to the quantity of water entering it from the returns so that there can be no accumulation of water in the tank, and as it is always partly full of steam, the water from it enters the boiler at the full temperature of the steam with which it is in contact, and with a steady continuous flow as fast as it enters the tank. The steam pipe on the tank is piped to the pump, and the suction of the pump is piped to the bottom of the tank into which it projects upwards a short distance, thus forming about it (in the bottom of the tank), a trap to catch all dirt or scale which would otherwise pass into the pump.

The pump and tank are piped together ready for use, and need only to be connected to the boiler, and the return pipe from the circulation.

Further information may be obtained of the manufacturers, The Curtis Regulator Co., 63 Beverly street, Boston.



FRACTURES IN STEEL BOILER SHELLS.

The fracture of the steel shell of a marine boiler on board the steamship *Ethiope*, some time since, regarding which a report was recently issued by the British Boardof Trade, is discussed by *Practical Engineering* as follows:

The boiler in question was one of the two main boilers, and was of the double-ended type, measuring 14 ft. 6 in. in length by 11 ft. 6 in. in diameter, having two furnaces at each end leading into a central combustion chamber, fitted with return smoke tubes arranged in the usual way. The shell was constructed in three belts, the plates being 1 in. in thickness, united with treble-riveted butt straps at the longitudinal seams, while the circumferential seams were lap-jointed and double-riveted throughout, the rivets being 1⅜ in. diameter, and pitched 4½ in. apart. It will thus be seen there was nothing unusual in regard to the construction of the boiler, which was of the ordinary marine type. It was built by Messrs. Richardson and Son, West Hartlepool, in 1889, under Lloyd's survey, and was certified by Lloyd's at the time the fracture occurred.

From the report it appears that on the day before the boiler failed the vessel was lying in the port of Dunkirk, and the fires were lighted between 5 and 6 p.m. for the purpose of slowly raising steam, and kept gently burning till a little past midnight, when the donkey pump was started with a view to promote circulation, the water being alternately drawn from one boiler and pumped into the other up to about four o'clock the following morning, when this operation was stopped. At about 10:30 a. m. the engines were turned round by steam, the pressure being then about 120 lb. At 12 o'clock, noon, the vessel started to clear the harbor and at about 1.40 p.m., when about eight miles off Dunkirk, the shell bottom of the boiler suddenly fractured, the crack opening about 1-16 in. wide, and running circumferentially through the solid plate of one of the end belts for a length of about 30 in., close to the ring seam of rivets uniting it to the middle belt of plating.

Fortunately the damage was confined to the emptying of the boiler and its consequent disablement; but it is not difficult to conceive that a fracture of a little more extensive character might easily result in complete rupture and explosion of the sheel, with consequences that, in the case of modern marine boiler working at 150 lb. or 160 lb. on the inch, can hardly be contemplated without a shudder. It would, therefore, be much more satisfactory if in the present case some reliable explanation could be adduced for the cause of the failure. Unfortunately the report affords little room for congratulation on this point. The surveyor who made the inquiry, contents himself with the assertion that the fracture "was caused by the strain brought to bear at the bottom of the shell plate by the unequal temperature and corresponding unequal expansion between the bottom and upper part of the shell."

The facts we have quoted, however, lend little support to this view. As will readily be seen on reference to the figures, the time occupied in raising steam was not less than is usually allowed for this purpose, and coupled with the fact that a certain amount of artificial circulation was secured by means of the donkey pump, is certainly inadequate, in our opinion, to account for the casualty, and we are glad that Mr. Traill, the chief engineer of the Board of Trade, in commenting on the case, does not allow the opinion of the surveyor with regard to the cause to pass unchallenged.

In such cases as these the testing machine, although not an infallible guide, is much more likely to throw light by affording an indication of the quality of the material. But although its aid was invoked, the results furnished do not shed much light on the cause of the failure. Two test pieces cut from the fractured plate, gave an ultimate tensile stress of 26·6 tons per square inch, and an elongation of 28 per cent. in a length of 10 in., with a sound silky fracture, while two other pieces, each 2 in. broad, bend cold to within a radius of ¾ in. without showing signs of fracture; so that, as far as tests go, they proved the material, which was made by Colville & Co., was of good quality. It should, however, be remarked that the plate from which the test strips were cut had been first heated and straightened for the purpose of serving as a template for the repair plate, and the tests would have been of greater scientific value had the strips been cut before the plate was annealed.

It is possible that the plate may have been injured in the working, and several cases of fracture have been recorded in which the damage was traceable to the fact that the plate was heated before being bent to the curve of the shell, and was subsequently worked at a dull heat, a practice which, as is now well known, is highly objectionable. No explanation of this kind, is permissible in this case, as the plates are stated to have been bent cold, and the rivet holes subsequently drilled in with the plates in position. In the absence, therefore, of any proof of defective quality of material, or injurious treatment while in a partially heated condition, we are compelled to assume, like Mr. Traill, that the plate received some local injury during the process of construction, possibly through the workmen flogging out a buckle or set in the plate, and that the initial stresses thus brought into play, combined with the punishment which all marine boilers receive more or less through unequal expansion were more than the plate could stand. There is, of course, no direct evidence that this explanation is the correct one; but it should be considered that such punishment as we refer to seldom affords much positive evidence of its existence, while subsequent annealing and straightening would be calculated to efface any slight traces which might exist.

We certainly should not like to admit that the cause of the fracture was enshrouded in impenitrable mystery. Careful investigation and experience both combine to show that failures of steam boilers can generally be accounted for by simple causes, and that, when difficulty occurs in fixing upon some specific reason, it arises mainly because direct evidence is destroyed. The moral, in fact, of the present case is not that steel is an unreliable material for boiler construction. On the contrary, we consider the improvement in steam engine economy effected during the last decade is mainly owing to its general adoption. Its valuable properties, its homogeneousness, and its ductility deserve and require respect, and in its working it should be remembered that an incipient crack, which would be of little or no importance in a wrought-iron plate may in the case of a mild steel plate suddenly develop into a defect of serious magnitude. This is the lesson we wish to convey, and which in these days of high pressure it is important those who are responsible for the construction of steam boilers should lay well to heart.

This is not by any means the first instance in which the shells of steam boilers have suddenly fractured while at work. Several disastrous explosions have come within our experience which owe their origin to sudden fractures, and those having experience of externally-fired boilers will be aware of the tendency which they have to occasionally fail in this way; but in all these cases the boilers have been made of iron. The shell plates of several steel boilers have, it is true, given way under the hydraulic test, and cracks have also occurred in course of construction while hammering or laying up; but, as Mr. Traill points out, this is the first time a steel shell plate has cracked while the boiler was under steam, and it is earnestly to be hoped, in view of the high pressures now existing, and of the disastrous consequences that might ensue from such failures, the first experience will be the last.

It would be a right that an inventor should have his patent sustained when he produces that document in court with the United States government's seal attached thereto.

THE JEFFREY STEAM STEVEDORE.

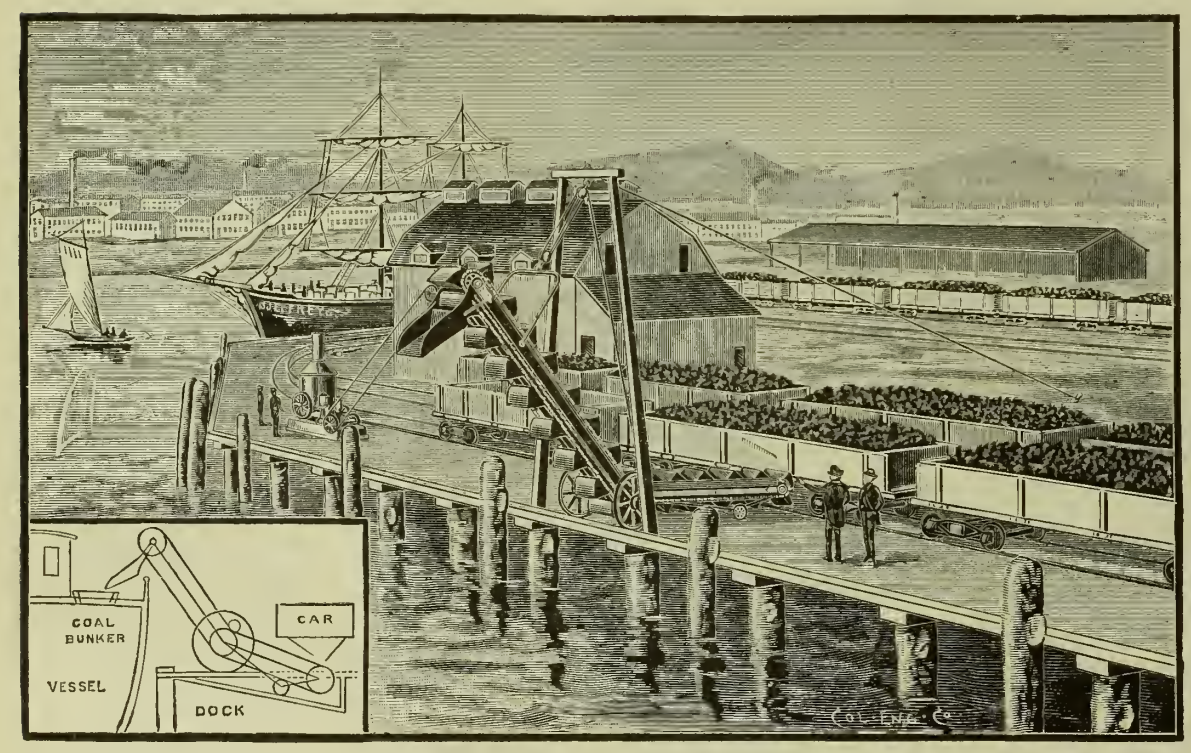
This is a machine for loading coal, grain, lime, ores, etc., on board vessels from cars or storage. It consists of two hinged frames arranged to be supported upon the axles and wheels of a heavy truck, and to support the shafting, bearings, chains, guides and buckets of an endless elevator.

When not at work, the two portions of the frame are closed nearly together, the top portion resting upon a bolster trestle, the hinged end supported on axle and wheels as shown in cut, the other end with bolster trestle on another axle and wheels not shown. When folded and loaded as described, the whole apparatus with shears and guy wires can be transported readily from place to place.

The illustration shows the machine ready for work to take coal from railroad transportation and deliver to vessels alongside of the dock. The top of elevator is guyed in position and is driven by rope transmission from an ordinary dock engine connecting with worm and gear.

This machine can be placed, as shown, with the horizontal ladder running under and taking coal from the bottom of cars, or it can be placed at right angles to the position shown, with the horizontal ladder parallel to the railroad track, when a number of shovelers would load the passing buckets, and a chute from the head would convey the coal or ore to the hatch of the vessel.

The wide field of usefulness of this machine is



apparent at a glance, and it is especially valuable to stevedores at points where inland transportation on rivers, bays or canals necessitates the use of barges, and where a capacity of 150 to 300 tons per hour at a moderate elevation of 25 to 30 feet is desirable.

Its portability renders it as useful to the stevedore or shipper, as the hoisting engine.

This machine is manufactured by The Jeffrey Manufacturing Company, who are well known throughout the country as successful manufacturers of elevating and conveying machinery for handling material of all kinds. Their main office and works are at Columbus, Ohio, with a branch at 48 South Canal street, Chicago, Ill.

STEEL AT VARIOUS TEMPERATURES.

The testing of steel at various degrees of temperature has been practiced in almost all countries, and now an account is given of the tests made by the French Government of steel way down in the low temperature of 75° to 100° below Farenheit. In these experiments part of the bars employed were hardened and part otherwise. The breaking load was increased by the cooling 3 per cent. in the instance of the unhardened bars and some 6 per cent. in that of those hardened; but in a shock such as a gun would be subjected to the unhardened bars, cooled, broke on an average with 5.9 blows, against 14.6 blows under ordinary conditions. With the hardened bars the difference was less, 12.57 blows being required for the cold bars, against 14.4 at the nominal temperature. The bars, both hardened and unhardened, had their elastic limit raised 11 per cent by the cold, and their elongation was diminished by 12 to 14 per cent.

PROPORTIONAL DIVIDERS.

A considerable portion of the draughtsman's work consists in making copies of drawings to a reduced or to an enlarged scale. For this purpose he has at his disposal various instruments, the principal ones being the proportional dividers, the pantograph and the eidograph.

Proportional dividers are a very useful and ingenious instrument by means of which not only the lines of a drawing may be reproduced so that they shall bear in the copy a given ratio to those of the original, but the drawing may be so reproduced that the areas of any given plane surface, or the contents of any solid shall likewise be proportionate to those of the original.

Proportional dividers are composed of two legs, 6 to 9 inches long, with fine steel points at their opposite extremities; these legs turn around a movable pivot, the position of which may be so adjusted that the ratio of the distance between one pair of points to the distance between the other pair of points may be varied to any extent.

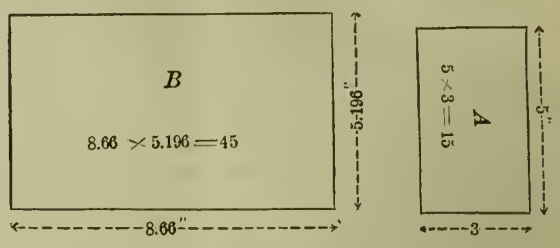
These adjustments are facilitated by means of a series of graduations or scales on the legs, any one of which may be made to coincide with a line traced across the slider attached to the pivot and running in a longitudinal groove in the legs. Common dividers have but one series of graduations giving ratios from 1:2 to 1:10, whilst the best instruments have four scales of graduations on the legs, namely a scale of lines, a scales of planes, a scale of solids, and a scale of circles.

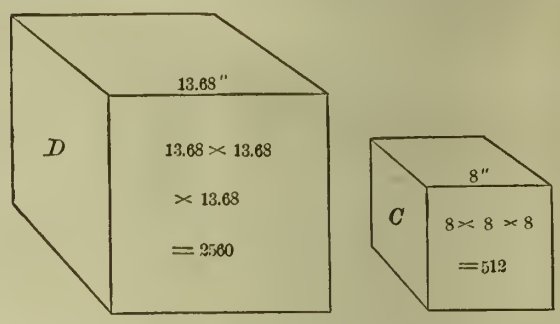
The scale of lines gives the ratio of the length of any given line taken in the opening at the end of the dividers to the length of the line as measured by the opening at the other end of the dividers, so that by it a drawing may be reproduced in any of the following proportions:

Enlarged from.	Or Reduced from.	SCALE NO.
1 to $1^1/_{11}$	1 to $^{11}/_{12}$	$^{11}/_{12}$
1 to $1^1/_9$	1 to $^9/_{10}$	$^9/_{10}$
1 to $1^1/_7$	1 to $^7/_8$	$^7/_8$
1 to $1^1/_5$	1 to $^5/_6$	$^5/_6$
1 to $1^1/_3$	1 to $^3/_4$	$^3/_4$
1 to $1^1/_2$	1 to $^2/_3$	$^2/_3$
1 to $1^2/_3$	1 to $^3/_5$	$^3/_5$
1 to 2	1 to $^1/_2$	2
1 to $2^1/_2$	1 to $^2/_5$	2.5
1 to 3 to 10	1 to $^1/_3$ to $^1/_{10}$	3 to 10

The scale of planes gives the ratio of the squares of the openings of the opposite ends of the dividers, and is used for making the copy of a drawing in which the area of any given plane figure is required to bear a certain proportion to that of the original.

If, for example, we wish to make a copy of a plane figure A, so that its area shall be 3 times as great as that of the original, we set the slide to 3 of the scale of planes, and take in the narrow opening the length of the sides forming the figure A and transfer them by the wide opening to the copy represented by figure B, whose area will then be three times as great as that of A, although the ratio of the respective lines of the two figures will be as 1:√3 or as 1 to 1.732. It will be seen at a glance how much time is saved by this simple method of enlarging or reducing plane figures, instead of being compelled to calculate the proportionate value of each line composing the figure by multiplying it by √3.





The scale of solids gives the ratio of the cubes of the openings of the opposite ends of the dividers, and is used to reproduce any solid figure, whose contents are required to bear in the copy a given proportion to those of the original.

Suppose, for instance, we wish to make a copy of the cube C, whose side is equal to 8 inches on a scale of 1 inch = 1 foot, but the contents to be 5 times as great as those of C. We set the slider to 5 of the scale of solids, and take in the narrow opening the length of the different sides and transfer them by the wider opening to our copy, which will have the dimensions of D, its cubic contents being 5 times as great, and its sides $\sqrt[3]{5}$ or 1.71 times as long as those of C. On measuring our copy D, it will be found that the length of a side is by the same scale of 1 inch = 1 foot equal to 13.68 inches; and that the result as obtained by the instrument is correct, is proved by cubing the sides 8 and 13.68, which gives us respectively 512 and 2560, the latter being 5 times the former.

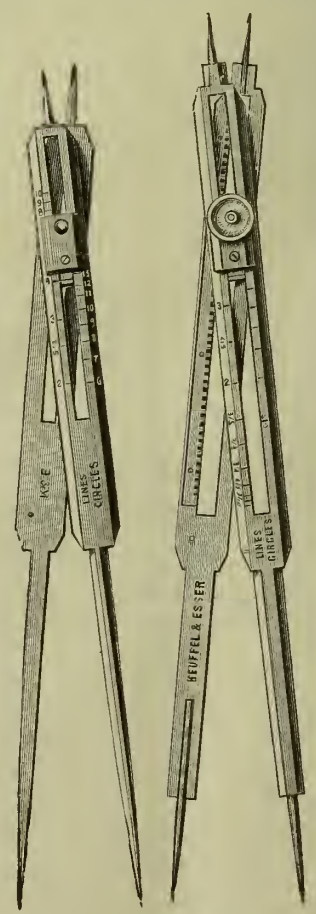


FIG. 1. FIG. 2.

The time saved by using this instrument is even more apparent in the case of solids than in that of planes.

The scales of circles gives the ratio of the diameter of a circle (in some cases the radius) to the side of any inscribed regular polygon from 6 to 20 sides, and is used for dividing the circumference of a circle into any number of equal parts up to 20.

A line marked G. S., found on some instruments on this scale, gives that proportional division of a straight line into two parts wherein the whole line is to the greater part as the greater part is to the lesser part, whence the greater part is equal to the

whole line multiplied by $\frac{(1\sqrt{5}-1)}{2}$ or 0.618. The greater part is thus a mean proportional between the lesser part and the whole line.

The illustrations show different models of proportional dividers of the very best quality and workmanship, namely:

Fig. 1—7½ inches long, finely divided for lines and circles.

Fig. 2—9 inches long, divided for lines and circles, with rack movement and movable steel points which are held firmly by screws, so that they can be reset to their original length in case of breakage.

Fig. 3—9 inches long, finely divided for lines, planes, solids and circles, with micrometer adjustment, permitting of accurate settings both of the openings of the points and also of the slider to any particular graduation.

Similar models of inferior quality and finish may also be had, but in the case of instruments, of whatever kind, the best alone should be used, if accurate work is either desired or expected to be done. Those described are strongly recommended, and may be used without the slightest hesitation.

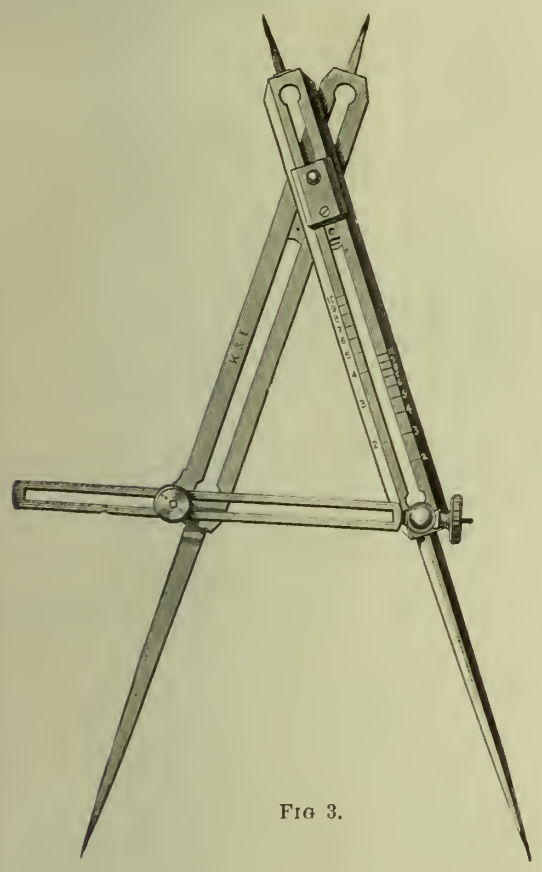


Fig 3.

We have often thought that if the ordinary proportional dividers had the scale of circles, which is but little used, replaced by a graduated scale of say 250 equal parts, from point to point, any ratio might be set off between the openings of the two ends. The dividers could then be used for many other purposes than those indicated by the different scales graduated on the instrument itself.—*The Compass.*

LECOMPTE AND HIS BALLOON.

Henri Lecompte, Director of the School of Aerostation at Paris, will soon make a rash attempt to cross Africa by balloon, starting from Mozambique. The peculiar feature of this balloon is a special apparatus for the production of hydrogen gas, so as to maintain the floating power. This gas is to be generated during the night time. The balloon will carry provisions for 100 days and will have a capacity of 10,000 cubic meters. Experienced aeronauts believe that this is a very hazardous undertaking. Lecompte proposes to cross Africa in its wider part, making a longer journey than any yet recorded. If an accident occurs to his air ship his chances for reaching civilization are about as slim as they would be if he descended in the middle of the Atlantic, for if compelled to abandon his balloon he is almost certain to find himself in a savage wilderness, hundreds of miles from succor, and very likely among hostile natives.

LOCALIZATION AND REMEDY OF TROUBLES IN DYNAMOS OR MOTORS.—III.

By Prof. Francis B. Crocker and Dr. S. S. Wheeler.

Continued from page 133.

HEATING IN DYNAMO OR MOTOR.

General Instructions.

The degree of heat that is injurious, or even objectionable, in any part of a dynamo or motor is fortunately very easily and quite definitely determined in ordinary practice. All that is necessary is to place the hand on the various parts, and if it can remain without discomfort the heat is entirely harmless. But if the heat is unbearable for more than a few seconds the safe limit of temperature has been passed, and it should be reduced in some of the ways that are given below. If the heat has become so great as to produce an odor or smoke, the safe limit has been far exceeded, and the current should be shut off and the machine stopped immediately, as this indicates a serious trouble, such as a short-circuited coil or a tight bearing. The machine should not again be started until the cause of the trouble has been found and positively overcome. Of course neither water nor ice should ever be used to cool electrical machinery, except possibly the bearings in large machines, where it can be applied to the bearings as a cooler without danger of wetting the other parts.

The above simple method will answer in ordinary cases, but, of course, the sensitiveness of the hand differs, and it makes a very great difference in the feeling whether bare metal or cotton-covered wire is touched. Hence, for accurate results, a thermometer should be applied and covered with waste or cloth to keep in the heat. In proper working the temperature of no parts of the machine should rise more than 40° C. or 72° F. above the temperature of the surrounding air. If the actual temperature of the machine reaches boiling point, 100° C. or 212° F., it is seriously high.

It is very important in all cases of heating to locate correctly the source of heat in the exact part in which it is produced. It is a common mistake to suppose that any part of a machine which is found to be hot is the seat of the trouble. In every case all parts of the machine should be felt to find which is the hottest, since heat generated in one part is rapidly diffused throughout the entire machine. It is generally much surer and easier in the end to make observations for heating by starting with the whole machine perfectly cool, which is done by letting it stand for one or more hours, or over night, before making the examination. When ready to try it, run it fast for three to five minutes, then stop and feel all parts immediately. The heat will then be found in the right place, as it will not have had time to diffuse from the heated to the cool parts of the machine. In fact, after the machine has run some time any heating effect will spread until all parts are nearly equal in temperature, and it will then be almost impossible to locate the trouble.

II.—HEATING OF ARMATURE.

1st Cause.—*Excessive current in armature coils.* Symtoms and Remedy the same as Sparking No. 1.

2nd Cause.—*Short-circuited armature coils.* Symtoms and Remedies the same as Sparking, No. 5.

3rd Cause.—*Moisture in armature coils.*

Symptom.—Armature requires considerable power to run free. Armature steams when hot, or feels moist. This is really a special case of No. 2, as moisture has the effect of short circuiting the coils through the insulation. Measure insulation of armature.

REMEDY.—Dry the armature in a warm, but not hot, place. This may be done very neatly by passing a current through the armature, which should be regulated so as not to exceed the usual armature current.

4th Cause.—*Foucault currents in armature core.*

Symptom.—Iron of armature core hotter than coils after a short run, and considerable power required to run armature when field is magnetized and no load on armature. This may be distinguished from No. 2 by absence of sparking and absence of excessive heat in a particular coil or coils after a short run.

REMEDY.—Armature core should be laminate more perfectly, which is a matter of first construction.

III.—HEATING OF FIELD MAGNETS.

1st Cause.—*Excessive current in field circuit.*

Symptom.—Field coils too hot to keep the hands on.

REMEDY.—In the case of a shunt-wound machine decrease the voltage at terminals of field coils, or increase the resistance in field circuit by winding on more wire or putting resistance in series. In the case of a series-wound machine, shunt a portion of, or otherwise decrease, the current passing through field, or take a layer or more of wire off the field coils, or rewind with coarser wire. This trouble might be due to a short circuit in field coils in the case of a shunt-wound dynamo or motor, and would be indicated by one pole-piece with the short-circuited coil being weaker than the other; one of the coils would also probably be hotter than the other; but this can only be remedied by rewinding short-circuited coil. Measure resistance of field coils to see if they are nearly equal. If the difference is considerable (*i. e.* more than 5 or 10 per cent.) it is almost a sure sign that one or both coils are short-circuited or double-grounded.

2nd Cause.—*Foucault currents in pole-pieces.*

Symptom.—Pole-pieces hotter than coils after a short run. The pole-pieces being bare metal and coils being covered, when making comparison it is of course necessary to keep hand on coils some time before full effect is reached, and even then it is reduced.

REMEDY.—This trouble is either due to faulty design and construction, which can only be corrected by rebuilding, or else it is caused by fluctuations in the current. The latter can be detected, if the variations are not too rapid, by putting an ammeter in circuit, or rapid variations may be felt by holding a piece of iron near the pole pieces and noting whether it vibrates. A direct current does not usually vary enough to cause this trouble, but in the case of an alternating current it is necessary to use laminated fields to avoid great heating, and the ordinary arc currents fluctuate enough to cause some trouble in this way.

3rd Cause.—*Moisture in field coils.*

Symptom.—Field-circuit tests lower in resistance than normal in that type of machine, and in the case of shunt-wound machines the field takes more than the ordinary current. Field coils steam when hot, or feel moist to hand.

REMEDY.—Dry the field coils in a warm but not hot place. This may be done simply by passing a current through the field coils, which must be regulated so as to not exceed the usual field current.

(*To be continued.*)

NEW APPLICATION OF AN OLD ACT.

The construction formerly put upon an act of Congress passed March 3, 1879, has allowed all printed matter from foreign countries to be mailed to New York. The circular issued by the Treasury Department, dated July 28th last, orders the seizure of all printed mail matter except books. This applies to the various kinds of printing processes, such as engravings, etchings, photogravures, half tones, sheet music and photographs.

The result is that Collector Fassett's contraband mail seizures, at New York, have reached prodigious proportions. And the complaints against the new application of the act passed over 12½ years since are loud and numerous.

Mr. Frank Hegger, a well-known dealer in etchings, engravings, water-color pictures, and photographic views, at 152 Broadway, New York, kicks against the new state of things, and objects to the enforcement of the act in question. He makes a special appeal, through the press to "the intelligent public" to bring about a "much needed and permanent reform."

Connecticut last year took out more patents in proportion to population than any other State in the Union.

The American Engineer.

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JEFFERSON YOUNG, JR.
Supreme Chief Engineer A. O. of S. E.

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CONTENTS OF THIS NUMBER.

TO THE A. O. OF S. E.

Rome was not built in a day, to quote an old saying, and neither can the new management of this journal make it what they feel it ought to be, viz., an educator, a home instructor, and of prime benefit to all engineers, in a day or even six months. But, we will push forward as fast as possible, never getting beyond our depths, financially or otherwise and hope to make THE AMERICAN ENGINEER one of the strongest engineering journals of the day, if a sound financial and energetic policy stand as an emblem of success.

In this laudable endeavor, we ought to have the support of every member of the A. O. of S. E., as they cannot but feel that the organ of the Order portrays to some considerable extent the condition of the Order in general.

This journal ought to be in the hands of every engineer of the Order and by securing from their friends outside of the Order, new subscriptions for the paper help spread the truths on which the Order is founded.

There is no question but that this Order will soon surpass in membership any similar organization in this country; but to accomplish this end, every one ought to do his utmost, individually, to bring it about. "In union there is strength."

The pages of the journal will be divided into departments, as follows:—

New mechanical devices, industrial items, editorial items, "our friends," the A. O. of S. E., correspondence, miscellaneous matter, the women's department, and others as, from time to time, are thought advisable.

The journal will shortly be enlarged, and the new features that will be added are sure to prove profitable to all concerned.

Members of the A. O. of S. E. are, to a great extent to be criticized on account of the acts of their organ, and they should, in justice to themselves, try to keep it up to the standard and above reproach.

Further information will be given about it through the regular channels of communication to the different councils; but these brief remarks will be appreciated by every one, we hope, and success is sure if the ideas are followed out.

TO OUR SUBSCRIBERS.

To the end that the new subscription books now being written up will leave no one out who ought to have the paper, we would ask those who are now receiving it to drop us a postal giving their full name and address, that there may be no chance of error, and if any one has cause for complaint, we assure them that the cause will be removed.

We wish to have everything in first-class order, and a system started that will keep matters in proper shape.

WHO WILL BE THE WINNER?

With the view of bringing up the circulation of THE AMERICAN ENGINEER to fully 20,000 copies each issue, the new management offer a premium of $40 to the one who will send in the greatest number of new subscriptions, $20 to the one who will send us the second greatest number, and $10 to the one who sends the third greatest number of new subscriptions, by January 1, 1892.

AN ENGINEER "MISSING."

We are informed that detectives are looking for Timothy M. Cronin of New York, who mysteriously disappeared from his home, No. 966 Sixth avenue, last May, and has not since been heard from. He was engineer at the New York Hotel, and it is thought came to Chicago and is now employed as an engineer in this city. The detectives have been unable to find any clew as to his whereabouts. His wife is living in destitute circumstances in New York.

THE RUBBER SYNDICATE FAILURE.

Some time ago we referred to the formation of a syndicate by a certain Baron Vianna, whose object was the usual one of such combinations, namely, so to control the supply of indiarubber as to send up its market price. We remarked on that occasion that the operations of the Baron had caused no special excitement on this side of the Atlantic, although his movements appeared to be watched with considerable interest in the United States. The subsequent course of events has fully justified the coolness of the European operators in this class of materials, for the Baron's syndicate has "bust," and the members of the ring are alleged to have been let in very heavily. According to certain American journals, which are usually well informed, the Baron's plans have gone "agley" chiefly because he failed to obtain sufficient financial support from his backers at the most critical period of his operations. In addition to this want of monetary solidarity, it is probable that the nature of the crop and the method in which it is marketed were adverse to the views of the manipulators. Owing to the overflow of the Amazon, the collection of rubber in Brazil is largely restricted during the months of June, July, and August, yet, even during those months a certain quantity comes to hand—sufficient to check any great rise in values. The Baron's supporters do not seem to have thought it necessary to acquire these small lots; but as the mouse is fabled to have liberated the netted lion, so it would seem these small lots spoiled the game of the syndicate. The supply thus forthcoming was naturally much stimulated by the high prices paid at Para, and the syndicate soon realized that to properly corner rubber they must "plank down" about double the number of dollars originally thought to be ample for the purpose. The capital of the syndicate is said to be $10,000,000, or about 2,000,000*l.*, and it is alleged that about $2,500,000, or half a million sterling, has been lost, $1,500,000 by Brazilian capitalists and the other $1,000,000 by English banks. The English members seem to have been somewhat left in the lurch by their smarter Yankee associates, the latter having unloaded at prices commencing at about 80 cents per pound, whilst the Britishers did not get out at much, if any, over 65 cents to 68 cents per pound. It is mentioned by one American journal that Baring Brothers held 500 tons of the syndicate rubber, and sold it all at from 63 cents to 68 cents—whether against advances or otherwise is not stated. Altogether, it is estimated that the syndicate held some 3,600 tons of rubber, the greater part of which had cost over 80 cents per pound, laid down in London or New York. According to current reports in the United States, the combination broke down just in the nick of time, for the American consumers, who were bare of stocks, had taken contracts for goods which they must have filled by the middle of September, and could not have held out much longer. As a proof of these points, it is mentioned that during the last three weeks of August the American manufacturers bought over 4,000,000 pounds, or about 1,785 tons. Had the real necessities of the American market been accurately known to Vianna and his friends, the combination would in all probability have made a last and more successful effort. As it is, the rubber "ring" collapsed, and the market for that important commodity is again free from manipulation.—*The Ironmonger* (London.)

MAXIM'S AIR SHIP.

Mr. Maxim, the inventor of the maxim gun, is now completing his invention of an aerial machine which he asserts will be superior to all other agencies of destruction in warfare. He has already spent $50,000 on his invention and if necessary $50,000 more will be expended to insure success. The machine is building at Crayford, near London, and is nearly ready for a practical trial. Maxim has made an exhaustive series of experiments to test the practicability of his idea, and it remains to be seen whether he can carry out his scheme with a full-sized machine.

He says his invention has been recently tested while captive, the engine propelling it being at work, and he thinks he proved it to be capable of carrying at least 10,000 pounds. The weight of the full-size machine, including men, engine, fuel, water, and all accessories, is 5,400 pounds. The fuel is gasoline, giving 5,000 gas jets. The machine is propelled by two screws and there is an engine to each screw. Maxim obtains buoyancy by the pressure of the air on the under side of sundry planes inclined upward, this pressure being due to the forward motion of the machine as it is driven by the propeller. He expects that the machine will actually lift itself from the earth. The men who first navigate it will undoubtedly incur great risk, if indeed they can get it above the earth at all. Mr. Brearey, who has made air machines a study, says that the working data for Maxim's machine can be obtained only by free flight. "We cannot, therefore," he says, "expect success at the outset."

As yet everything is purely tenative, and Maxim's friends can only hope that he is on the right track. His idea is that, with such a machine, destructive projectiles can be hurled down upon an enemy with annihilating results. Those who know what his intention is say he has at least devised a lighter motor than has been previously invented for use in air machines.

OUR FRIENDS.

1.—ROBERT FORSYTH.

There is always a satisfaction in knowing something about the persons counected with us, their appearance, history, characteristics, position in life, etc., as then it seems, somehow, easier to treat with them in matters of mutual interest.

So we open a department for "Our Friends," in order to bring the A. O. of S. E. into a closer relationship with those interested in it.

It is proper that we should start with one who has eminently shown his friendship for the A. O. of S. E., and we give below a fair likeness of him and a brief sketch of his life—so far.

Robert Forsyth, President and Treasurer of The American Engineer Publishing Company, was born in the Parish of Cults, County of Fife, Scotland, February 6th, 1866, and, is therefore not quite 26 years of age. His history is that of all boys, until, when about 8 years of age, both parents died, leaving him, with three sisters and two brothers—he being second youngest—at the mercy of the world. He then lived for a short period in North Berwick with an uncle, leaving there to enter Donaldson's Institution in Edinburg, September, 1874, where for six years he lived, laying the foundation for his future in a first-class education.

Robert Forsyth.

Leaving there in July, 1880, for two years he did nothing of special interest, but in January, of 1883, he came to Chicago, where his experiences have been varied.

His first position was with the Adams and Westlake Co., leaving there to enter the lumber business in 1885. In 1887 he entered the employ of a then comparatively small iron industry, which, owing largely to his energy and push, is now a leading concern in this city, and of which he is secretary and treasurer.

During the last two years he has been much interested in fire insurance matters, as a student, and has lately formed the Western Fire Protection Company, to deal in all kinds of fire appliances, the result of his convictions, that much of the losses sustained by fires can be stopped by a judicious system of protection. He is president and treasurer of this company, also, which bids fair when we consider the organizer, to be a sure success.

A few weeks ago he became interested in this journal, and largely through his endeavors, a complete change of management was effected.

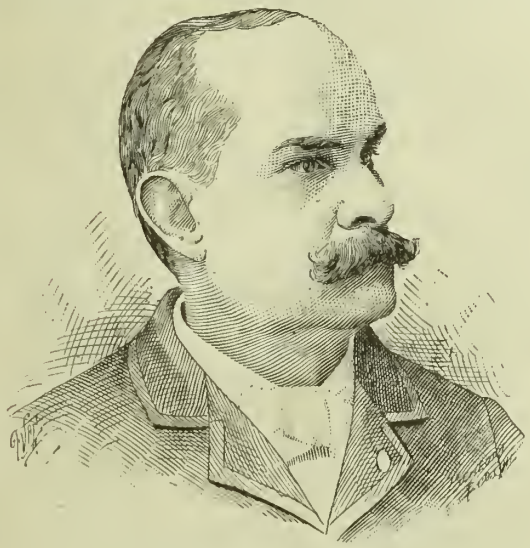
Mr. Forsyth's life has been a busy one since coming to Chicago, and we feel that he has well merited a rest, which he will shortly take by going to Scotland to visit his old school associates and the haunts of his earlier life.

All of the family are now in Chicago, so we feel that his connection with us is an assured fact. He married in February, 1889, Georgia Whyte, daughter of the late William H. Whyte of this city, who, as proprietor of the Eagle Pattern Works, was well known in manufacturing circles.

2.—JEFFERSON YOUNG, JR.

The Supreme Chief Engineer of the American Order of Steam Engineers, whose portrait is presented herewith, was born in New York City, March 23, 1851. He is therefore just past 40 years of age. When a mere boy he entered the merchant service between New York, Liverpool, London and Havre, serving fourteen years. And thus his apprenticeship with machinery and steam engines was served on the briny deep. He afterwards spent three years in a brother's machine shop in Brooklyn, and he thus qualified in the school of experience as a full-fledged engineer. Since 1882 he managed some of the largest machinery plants in New York City for some years, but finding that the engine room kept him too confined, for the good of his health, and as he longed for finer music than the hum of machinery, he started on the road selling steam pumps. He did well in the pump line; but he has just given that up, and removed to Chicago; and with him have come the headquarters of the Order.

While attending to his business, Mr. Young thought of an order of engineers for engineers, and engineers only. With the aid of three stanch friends he organized the first council of the A. O. of S. E. in Brooklyn, N. Y., April 27, 1887. At the start Mr. Young would not listen to the talk of being made Supreme Chief of the Order, and modestly took a subordinate position, giving preference to an elderly brother in the profession. That foolish modesty soon wore off, however, and in 1888, at Manchester, N. H., by which time the Order had



Jefferson Young, Jr.

grown to many hundreds of members, Mr. Young readily accepted the distinguished position of Supreme Chief, to which the Order unanimously elected him. At the next session, held in Boston, he was re-elected by a rising vote. Then, in 1890, at the Philadelphia convention, he was again entrusted with the reins of Supreme power; and a resolution was at that time adopted eulogizing and endorsing every act of his administrations.

In December last, owing to illness in his family, Mr. Young feared that he could not do justice to the duties devolving upon him as Supreme Chief Engineer, and he submitted his resignation to the Supreme Council. A special meeting was therefore held December 15, at Philadelphia, to take action on the communication. It was then decided to retain Mr. Young as Supreme Chief, in which capacity he still acts.

HINTS TO SALESMEN.

Cultivate the habit of doing everything rapidly; do thoroughly what you undertako, and do not undertake more than you can do well, says *Ironmongely*.

Lerve buycrs in their turn. If you can serve two at onco very well, but do not let the first ono wait for the second.

Never run down your competitors to customers. By so doing you advertise them. It won't pay you to get trade in that way. Competitors can talk back.

Chicago's Grant monument is a fact.

THE SERPOLLET BOILER.*

Professor Alexander B. W. Kennedy has recently made some experiments upon an interesting type of boiler which is, at least, out of the common, if not altogether new in principle. This is the Serpollet boiler. This boiler consists of a series of rings of flattened pipe, thus giving an oval section, through which the water circulates, and is thereby converted into steam, the heat from the furnace being on the outside of the pipes, after the usual plan of pipe boilers. The special feature about this boiler—as a pipe boiler—is that there is no steam and water separator, and, as the contents are small, it is necessary that the steam should be superheated in order that water may not be carried over into the engine cylinder. The separator has always been the questionable point in boilers of this type, and one has generally an uncomfortable feeling that separation is not always completely performed. It is perhaps for this reason that tests of machinery, in which a pipe boiler is the steam generater, show a relatively better performance for the boiler than the engine. A separator is an evil, but it has generally been looked on as a necessary evil with most types of pipe boiler from which a high evaporative efficiency is obtained. The long steam and water spaces with small sectional area make pipe boilers especially liable to priming, for if steam be formed rapidly—as it necessarily is when the heating surface is so large in comparison with the volume of water—the steam, as formed, has not time to pass through the water above, and the latter is therefore carried forward by the expansive action of the steam; much as the generation of powder gas forces a projectile out of the bore of a gun, excepting that the unevaporated water is broken up into a fine spray. It is questionable whether the best designed separator will entirely arrest this water, and M. Serpollet, doubtless recognizing this fact, has determined that in his boiler not only shall there be no priming, but that the fine water shall all be certainly evaporated. He therefore arranges the proportions of feed to heating surface so that the steam may be well superheated. In this way he has an ample margin of safety against priming. To secure this end it is necessary that there should be no large body of water in the boiler at any one time, and the feed is therefore introduced just so much at a time as is required to keep the engine going. The feed pump and engine therefore synchronise to this extent, that if the feed be stopped the engine immediately ceases to revolve. As a matter of fact this is the way in which M. Serpollet stops his steam carriage on ordinary occasions; simply by diverting the feed supply back to the tank instead of to the boiler. It will be evident from what we have said that the chief point of interest in Professor Kennedy's report will be that which refers to the superheating of the steam,

Superheating steam is, of course, no new thing, and at one time, when pressures were lower, the superheater was an ordinary part of a steamship's equipment, In early days, however, a temperature of about 350° Fahr. was considered as high as it was safe to go in marine practice, and this would correspond to the temperature of saturated steam at a pressure 120 lb. per square inch; which, of course, was far in excess of the marine practice of that day. It should be stated, however, that the late Mr. Perkins went far above this; but then Mr. Perkins, as he used himself to claim, was beyond his day. Since then we have made great strides in the design of piston and stuffing-box packing, and in the use of hydro-carbon lubricants, so that now pressures as high as 200 lb. can be and are used, although not altogether with impunity. The torpedo boat builders found it desirable to run without cylinder lubrication even when pressures were no higher than 130 lb. to the square inch, which gives a temperature but four or five degrees higher than the old standard. At 200 lb. pressure of standard steam the temperature would be about 40° higher than the 350° laid down as the original limit. M. Serpollet, however, soars above all prudential considerations, such as fettered our fathers in their engineering practice, and boldly superheated his steam to a degree which far exceeds a temperature corresponding to that of the highest pressures yet used in ordinary

* Abstract from *Engineering*.

practice. Indeed, in the experiments referred to, the probability is that the conditions approached those of working with a perfect gas. According to Professor Kennedy's report, the mean boiler pressure was 54.7 lb. per square inch above atmosphere, and the superheating in the steam chest was 194° Fahr. This would give a temperature of close upon 500° Fahr., or a temperature corresponding to that of saturated steam at a pressure of over 650 lb. to the square inch.

The duration of Professor Kennedy's trial was 7 hours 54 minutes. The engine was of the vertical type and of ordinary construction, having a 5-in. cylinder with a 5-in. stroke. The revolutions were 284 per minute, and the mean indicated horse-power 5.73. The cut-off was at six-tenths of the stroke, so that steam was only expanded 1.7 times. The grate surface of the boiler was but 1.146 sq. ft., and the coal burnt per square foot of grate per hour, 24.91b. The theoretical evaporative power of the coal was 15.43 lb. of water per pound of coal. The feed water evaporated per minute was 2.43 lb., which was equivalent to an evaporation of 6.97 lb. of water per pound of coal from and at 212° Fahr. The evaporative efficiency of the boiler, that is the heat usefully expended in the formation of steam, was 45.2 per cent., 32.4 per cent. of heat being carried off in the waste gases, and 22.4 per cent. being lost by radiation. That is not a bad result for a boiler of this small size, but it must be remembered that the steam given off by this boiler is undoubtedly all steam, and further that it is steam of unusual potency, containing as it does a large reserve of heat; so much so that the exhaust was superheated 55° Fahr. The coal consumed was 4.97 lb. per indicated horse-power per hour, but the feed water per indicated horse-power per hour was no more than 25.44 lb. The latter figure for an engine of this description is altogether remarkable, probably without precedent, and clearly indicates the value of superheating.

These results are generally in accordance with those obtained by an elaborate series of experiments made some years ago—but, we believe, never yet published—by Mr. Isherwood in America. These trials were made upon a yacht fitted with compound engines of about 150 indicated horse-power, the steam being generated by a coil boiler. The boiler pressure for eight of these experiments varied between 130 lb. and 21 lb. per square inch. Mr. Isherwood says: "A great many comparative experiments with steam machinery show that for the same engine working against a resistance which varies as the square of the piston speed, with steam in a saturated state and used within the same measure of expansion, the cost of the total horse-power is not affected either by the steam pressure or the piston speed. Applying this result to the experiments in question, in connection with the fact that for experiment H the steam was used without superheating or in the saturated state, the cost of the total horse-power in that experiment may be taken as what would be its cost in all the other experiments had they been made with saturated instead of superheated steam, the other experimental conditions remaining the same.

Experiment.	Number of Degrees Fahr. Steam Superheated in Boiler.	Cost of Total Horse-Power in Fahr. Units of Heat Consumed per hour.	Percentage of Economy due to Superheating.
A	61.81	13,572	34.41
B	62.00	13,514	34.69
C	37.43	14,478	30.03
D	34.03	14,938	27.74
E	30.11	15,938	22.98
F	17.75	17,281	16.49
G	1.86	18,823	9.04
H	0.00	20,693	0.00

In these experiments the greatest temperature of the steam was 417° Fahr. This yacht was, we believe, in use for two or three years, and as the superheater was a permanent adjunct to the boiler, the steam was doubtless generally used at or about the maximum temperature named (for yachts generally run at about full speed) and no trouble was experienced with the engines so far as we are aware and we had more than one trip on the vessel. The 62° of superheating here recorded is, however, a very different matter to the 200° or so of the Serpollet boiler, and it would be interesting to learn in ordinary engines can be run successfuly with this very hot steam for extended continuous trials and over long periods of time. On this point we have further information. The boiler used in M. Serpollet's works has been providing steam for an ordinary engine since April 10, 1890. Professor Kennedy saw this engine working at a pressure of 9½ atmospheres, and a temperature of just over 500° Fahr., which included a superheat of 140° Fahr. Professor Kennedy found this engine in good condition, the cylinder surfaces being "smooth, glassy, and quite greasy." "Its condition," he said, "could not have been better." The eight hours of Profesor Kennedy's test is a fairly extended trial, and in his report he says that there was no sort of inconvenience with the engine, and the amount of oil used for cylinder lubrication was not excessive. Speaking generally, there is no doubt that superheating is an easy and cheap means of obtaining economy, and the results quoted seem to show that it may be used to high temperatures without detriment to the engines. However, in the Serpollet boiler the superheating has probably been carried beyond the requirement of economy.

There are other points in Professor Kennedy's report upon which we might touch. He speaks of the safety of the boiler, but this is apparent and does not need urging. As the American inventor said of his coil boiler, "a man could not commit suicide with it if he tried." With regard to capacity, it was found that the evaporation was 10.1 lb. of water per cubic foot per hour, the fuel being just under 25 lb. of coal per square foot of grate per hour. Comparing this with ordinary practice it would seem that the space occupied by the Serpollet boiler is small. In ease of management very satisfactory results were shown, the absence of anxiety as to the water level being a refreshing feature. The pressure also was kept constant with greater ease than an ordinary boiler. Professor Kennedy is of opinion that the Serpollet boiler is well adapted for use in places where apparatus can receive only unskilled or intermittent attention. The difficulty one would expect to arise in working a boiler with such restricted steam and water space as that of the Serpollet boiler, would be that arising through incrustation and choking. On this point Professor Kennedy's report has something to say. The boiler at M. Serpollet's Paris works is cleaned out every week, a process which takes a few minutes only, and it has never become choked. As an experiment another boiler was purposely choked up by using some very hard water obtained from a well. Professor Kennedy satisfied himself that the boiler was actually choked, and then applied the cleaning process, which consists of pumping through the boiler a dilute solution of hydrochloric acid (one of acid to seven of water). It took about three-quarters of a minute working the pump before anything passed, and in about two minutes the coil was perfectly clear.

FIBRELIA.

Further tests of fibrelia, the product of common flax straw, show that to a certain extent it has not only valuable textile properties of itself, but also as a substitute for cotton or wool; it is claimed, in fact, that 25 per cent of the fibrelia with 75 per cent of wool made into broadcloth gives a product absolutely more valuable than if made of wool alone—that is, the real strength of the cloth is enhanced, it is more impervious to water, is warmer, and, on account of its tenacity and flexibility, its cementing property and electrical adhesiveness, fibrelia not only imparts preservative qualities to the wool and increased durability to the cloth, but imparts to the whole a gloss and finish not otherwise attainable. Those who have made the closest examination of this peculiar article say that its specific gravity is greater than that of cotton, and the material is much stronger, in fact, like pure linen. Flax as is well known, is of a cellular composition, the same as wool, dyes therefore penetrating it throughout, its coloring capacity being equal to wool and fully as durable. Thus it is that fibrelia goods take a better color and hold it with more tenacity and brilliancy than cotton. This being so, cotton fibrelia goods, it is asserted, must excel pure cotton, in weight, strength, and beauty.

STEAM BOILERS FOR ELECTRICAL INSTALLATION.

By W. H. Booth and Frank B. Lea.*

It has been many times remarked that the dividends of any electric light or power concern are to be sought between the coal pile and the belt. This leaves out of question altogether the still unsettled and somewhat vexatious problem of conducting mains—not a few of the expenses that ought to be profits being incurred in this direction—but still the statement thus made possesses a very strong substratum of truth, and its importance cannot be too much emphasized.

And yet, of all the processes necessitating the use of steam power in some form or other, probably not one in the whole history of engineering has laid under contribution a more diversified range of steam generators than has the production of electricity for employment in lighting or transmission of power.

Portables, semi-portables, semi-fixed (what the difference is between these two would puzzle more than the author of "Tweedledum and Tweedledee"), multitubular loco, types, marine boilers, tubular boilers with steam drums; Lancashire, Cornish, externally fired, vertical—anything has been good enough to use with engines for driving dynamos, so long as pressure in the first place could be kept up for a sufficiently long time, without regard, secondly, to the coal consumption. These two factors, however—now that the production of electrical energy has settled down into an art that is understood—are causing the adoption of several more or less prominent types of boilers as being on the whole most suitable for the purpose; and the reason for this can be set forth accordingly as two in number also.

For the first few years of electrical progress, those engaged in it had more or less to make experiments; the whole art itself was in a chrysalis condition, and for the purpose of demonstration or working on a small scale, it was practically immaterial whether the boilers used three pounds of coal, or thirty, per indicated horse-power. But now that electric lighting is a business of strictly commercial character, the coal bill enters into balance sheets in every case, and usually forms a very important part thereof. The first reason, accordingly, for adopting any particular type of boiler for electric lighting is, that such type burns less fuel than others; it is more economical in working for a given output.

The second reason is of somewhat less permanent nature; it is dependent upon the conditions of public demand for the products of any electric light station. That is, the requirements of electric light users necessitate the employment of boilers which are rapid and plentiful steamers. The greatest demand for light is compressed into a space of some four or five hours per day, between 5 and 10 p. m.; and—assuming the supply is in all such cases *direct*, without the intermediary of storage appliances, secondary batteries or accumulators—the boilers must be of a type that will ensure plenty of dry steam at short notice. Of course, as the demand for a supply of current increases, or rather, as the opportunities for using current become more numerous, say in the direction of electric motors, the supply will be spread more evenly over the whole day, and the question of rapid steaming will not then prove so important in deciding upon the type of boiler to employ as will, for instance, the superior capacity of steady working over a long time. This applies to electrical installations of all kinds, whether public or private; for it is just as important that a private individual should get all he can out of his machinery, as it is for a company supplying the public with electric energy from a large central station.

So far as the latter are concerned, *i. e.*, central electric light stations, there is, of course, another reason still which has operated in the direction of specializing the types of boilers most available. The powers required are so very much in excess of those used in the early stages of lighting, that there is necessary something more than a mere reduplication of boilers. What seems to be wanted is an increase in the dimensions of steam generators—or,

*In the *Electrical Review* (London.)

any way, an increase in their output whilst at the same time the cost of operating them, *i. e.*, the cost of labor, (and consequently the number of furnaces) is kept the same, or is not proportionately increased.

Such qualities are, of course, claimed to be present in several of the types of boilers that are used most widely for large powered installations, and doubtless they are all equally serviceable (or nearly so.)

It is, however, a point that should be kept in constant view by boiler makers, viz., how far the cost of working a number of boilers may be decreased by increasing their individual dimensions consisistent with safety and good workmanship; the total outpnt in both cases being the same.

The question resolves itself into one of ascertaining the minimum number of furnaces that can be employed for a given total ontput of steam power.

Leaving now any further discussion of general principles, we may proceed to examine the various types of boilers used or usable for electric light work.

From what has already been said, it would appear as though the feeling of insecurity of tenure which characterized all early electric installation has had in common with the prevailing conditions of public demand for electric energy, so strong an influence on the steam department of electric lighting, as to a very large extent determine the character of the permanent plant of even large undertakings. This is evidenced by the extended use of the semi-portable locomotive type boiler, combined very often with an engine upon the same foundation plate.

That the boiler of the locomotive is an excellent one for its duty, few will deny; but it is by no means a rational corollary that the locomotive type of boiler is equally good when applied to stationary work, as it is when on the rails, or even over the keel of a torpedo boat. The conditions are so entirely different, that only a very superficial observer would argue that what does well in a traveling machine, must do equally well at rest. The narrow water spaces of the locomotive boiler are not the best calculated to promote water circulation, and so there is danger of the plates becoming overheated; but when running over a rail more or less uneven, or being rolled even in a comparatively smooth sea, the vibration and swilling motion no doubt are powerful factors in keeping the plates free of steam, and in water contact.

The locomotive type of boiler, too, is, in respect to the question of perfect fuel combustion, essentially a forced draught boiler, and when worked with an ordinary chimney draught, especially with the little iron chimney of small height so usual in temporary installations, it is not being treated in a fair manner.

Where boilers are of such a type that they produce smoke, complaints are sure to be made of the nuisance which they cause, and either there then arises the necessity of burning expensive smokeless fuel, or else a costly series of trials of nostrums begins, though it never ends.

Now the locomotive boiler to be smokeless and economical with ordinary bituminous fuel, should have a quick draught and a brick arch, and, when stationary, should have much wider water spaces than are usual in its proper sphere.

When thus designed in accordance with the conditions which will accompany it, and worked— as it should be—briskly, such a boiler will have a virtue which is, for instance, lacking in the vertical type; it will have a large body of water in it. Further, though the ebullition will be violent at and near the firebox, there is considerable length of barrel in which to deposit entrained water, so that the steam supplied to the engine may dry.

In the vertical boiler neither of these conditions is present.

To be continued.

The German patent law provides that inventions shall be considered new if they have been lost sight of for 100 years. The principle of granting subsidiary patents has been extended and the patent office has been a good deal remodelled, by the employment of legal and technical experts.

Mechanics head the list as inventors, then come clergymen.

CORRESPONDENCE.

Thomas Wilkinson Expelled.

Editor American Engineer:

This is to notify the Order in general that Thomas Wilkinson, of 2844 Lee street, Philadelphia, is expelled from our Council for receiving, through the Council a first-class situation and then allowing himself to become in arears for dues.

Yours fraternally,
Jas. Lightfoot, Cor. Engineer,
Kensington Council, No. 3, A. O. of S. E.

THE BOILER INSPECTORS' CONVENTION.

The following correspondence speaks for itself:—

Boiler Inspectors' Association of the United States and Canada.

St. Louis, Mo., Oct. 3, 1891.

Mr. Jefferson Young, Jr.,

Dear Sir:—We call your attention to the fact that the Boiler Inspectors' Convention of the United States and Canada, will be held in this city commencing Tuesday, October 6, 1891, at the Hall No. 620 Locust street, where some of the resident members will be present to receive all visitors. The Westerman Hotel Rozier has been selected as the headquarters, where some one of us will also be on hand.

Please advise me if you will be present so that we may make the necessary arrangements to entertain you. Come and see what St. Louis can do for her friends when they visit her, when the bars are down and everything is let loose and everybody on the run trying to see how pleasant they can make it for all strangers within our gates.

Yours very truly,
Wm. McClellan, President.

The following telegram was sent to Mr. McClellan in reply:

Chicago, Ill., Oct. 7, 1891.

William McClellan, President Boiler Inspectors' Association.

Your kind invitation received to-day, too late for me to attend. Convey to the officers and delegates to your convention my very best wishes for their success.

Fraternally yours,
Jefferson Young, Jr.,
Supreme Chief Engineer, A. O. of S. E.

THE FUTURE OF THE COLORADO DESERT—THE NEW LAKE AND ITS EFFECT.

The theory that the creation of bodies of water will ameliorate the desert conditions is the one now in hand. On this theory it has been proposed to revolutionize the desert of Sahara by taking water from the sea by a canal into a low basin of the desert, and, though physical geographers have again and again affirmed that this would not effect the climate in any appreciable manner, yet the scheme comes to the surface of popular agitation from time to time. So it has been proposed to change the Colorado desert by filling the Coahuila basin with water. But land is not assured against aridity by the presence of bodies of water. It has already been seen that the peninsula of California is almost surrounded by a body of water, and to the west is the great Pacific Ocean, and yet its aridity is excelled in but few places on the globe. On the Polynesian Islands there are atolls—that is, little bodies of land surrounded by vast ocean spaces—that are almost as arid as the desert of Colorado.

The future of the basin, if regulated by nature alone, will be as its past. From time to time a strand of the river will enter it and its bottom will be covered by a brackish lake; from time to time the whole current will pay tribute, it will be filled to the brim, and "Hardy's Colorado" will become "the Colorado;" from time to time the swaying river will avoid it altogether, the sun will drink its water, and a new film of salt will be added to its desert plain.

But the problem no longer belongs to nature alone, for civilized man is upon the scene. In the near or distant future he will control the river, and by its aid regulate the condition of the valley. Today he talks of obstructing the western sloughs by dams, so that the Colorado shall be permanently contained within its present channel, and the settlements and railroads of the basin shall not be compelled to choose new sites above the threatening tide. If this course is adopted and continued, the task of restraining the river will at first be comparatively easy, but the time will come when the tract of delta it now traverses will be built so high that massive and costly walls will be needed to restrain the struggling stream.—From "The New Lake in the Desert," by J. W. Powell, Director U. S. Geological Survey, in October *Scribner*.

MAKING COMPOUND METALLIC TUBES.

At one of the Pittsburg (Pa.) machine shops a new process has been introduced in the manufacture of compound metallic tubes; that is, tubes of one metal covered or lined, or both, with another metal. In the lining of the tube a hard mandrel is taken, the diameter of which is the same as desired for the inside of the lining of the tube when finished, and the metal lining is placed around the mandrel and rolled through or between hard-surfaced rolls until the lining is reduced to the desired thickness; the tube that is to be lined is now slipped over the lining and the rolling process continued until the tube is rolled tightly onto the lining and reduced to the outside diameter desired, after which the mandrel is removed and the tube cleaned. If the tube is to be covered as well as lined the the mandrel is left inside the lining, the metal cover is slipped over the tube, and the rolling process continued in the same manner until the metal cover is rolled down tightly upon the outside of the tube and the degree of thickness of the covering sought for obtained. After this the mandrel is removed and the compound tube finished according to the usual method.

TOO MANY LAWYERS.

Every lawyer in the country seems to be determined to get into Congress or perish, says the *Marine Journal*. The place is literally infested with them. A taste for political life is unhappily too often engendered by the deadly debating or literary society of one of our thousands of universities. The subsequent entrance into the arena of the county court room and the unquenchable desire to astonish the nation, breeds a craving for a more extensive audience. The horizon of Flapdoodle has to be enlarged. The pent-up Utica of a wild and woolhat district contracts the power of forensic effort. Even the legislature will not quiet the gnawing of the demon of Gab, and so they press on to the high calling and mark of Congress, where they can talk (through the *Record*) to their hearts' content. But ast, why the capacity to talk a Niagara of political platitudes should equip a lawyer for the intelligent discussion of matters relating to navigation is simply incomprehensible. Yet they swarm on committees charged with everything but legal matters or speech making, and inflict on a long suffering people their "statesmanship" in a way that is maddening to those who want practical men to legislate for them.

HOW SPOOLS ARE MADE.

Almost all the spools now made are produced from birchwood, and the machinery used in their manufacture has been brought to such a degree of perfection as to reduce their cost to the lowest possible figure. The wood is first sawed into sticks four or five feet long and seven-eighths of an inch to three inches square, according to the intended size of the spool. These sticks are thoroughly seasoned, sawed into short blocks and dried in a hot-air kiln at the time they are sawed, holes being bored perpendicularly through each block, which is set on end under a rapidly revolving long-shaped auger. At this stage one whirl of each little block against some small knives that are turning at lightning speed fashions it into a spool after the manner of the pattern provided, and this, too, at the rate of one a second for each set of knives. A row of small boys feed the spool-making machines by simply placing the blocks in a spout, selecting the best, and throwing out the knotty and defective stock. The machine is automatic, excepting the operation performed by the boys. After turning the spools are placed in a large drum and revolved rapidly until polished.

THE WOMEN'S DEPARTMENT.

The Daughters of Fulton have heartily wished for a Women's Department in the official organ of the American Order of Steam Engineers. Here it is. The women can now stand on their own ground, so to speak, and exchange their views. The men will not be allowed to trespass on this department, at all events, they must not come in until they are asked to.

"WOMAN" AND "LADY."

The word "lady" seems namby-pambyish and suggestive of frills and furbelows, as the Chicago *Tribune* puts it, in quoting from the Lafayette (Ind.) *Journal*, which says:

"'Lady' managers sounds finicky and affected and does not smack of business. It makes one think of the average sewing society, where female gossips meet to train their needle guns on the character of their neighbors. Let it be plain Board of Woman Managers. That old-fashioned word is good enough. Besides, it means something, which is more than can be said of the other term. The word 'lady' is so overworked these days that it has gone into disrepute. There is something suggestive of worth, of tenderness, of strength combined with gentleness, of dignity and motherliness in the name of woman. All the tributes to the sex in the great masters of literature are addressed to woman, not 'lady.' Imagine Scott writing:

"O 'lady,' in thy hour of ease,
Uncertain, coy, and hard to please,
And variable as the shade
By the light, quivering aspen made—
When pain and anguish wring the brow,
A ministering angel thou.

"It is clear that the substitution of 'lady' for woman in the above would ruin the dignity of the lines.

"So Otway:

"O woman, lovely woman, nature formed thee
To temper man.

"Thus Shakspeare:

"'Tis beauty that does oft make women proud;
'Tis virtue that does make them most admired;
'Tis modestly that makes them seem divine.

"Pope likewise:

"But grant in public men sometimes are shown,
A woman s seen in private life alone;
Our bolder talents in full life displayed,
Your virtues open fairest in the shade.

"Not a word about 'lady' in the whole catalogue. The examples might be multiplied indefinitely.

"Those of the sex who have made themselves eminent are alluded to as as women, not ladies. We speak of 'Shakspeare's women.' We allude to George Eliot as a great woman, Sarah Siddons as a noble woman, Joan of Arc as a heroic woman. But especially in business affairs does the term 'lady' seem namby-pambyish and suggestive of frills and furbelows. Observe that it is the 'Woman's Relief Corps,' the 'Woman's Foreign Mission Society,' the 'Woman's Christian Temperance Union.' Those and other similar organizations never emasculate their titles with boarding-school nomenclature. Impressed with these views we, therefore, move you, Mrs. President Palmer, to strike out the word 'lady' and substitute therefor the good old Saxon word, 'woman.'"

Mrs, Levi P. Morton, wife of the Vice-President of the United States, conducts her home much the same as does Mrs. Whitney. She is absolutely the head of her own establishment. She engages her servants, and does all the ordering for her table; she also devotes much time to the care and education of her children. She is a prominent leader in society, and fulfills all her home and social duties because she is a model of system in her methods. Not a moment is wasted. It is the same in money matters; though her husband is enormously wealthy, and she gives largely to charity, she looks after the pennies closely. She keeps an accurate account of all the moneys she receives and spends, and is punctilious in not running long accounts with the tradespeople. She pays all bills weekly by check.

THE CARE OF CANARIES.

BY MRS. M. C. WILLIAMS.*

In the care of canaries in the home, cleanliness even outranks godliness. Given that, with proper food and reasonable freedom from bad air, your bird's days will be long in the land, his song a delight to you eleven months in the year.

Do not expect a canary to sing while moulting. The growth of his fine new winter coat requires all the surplus vitality of his small body. Feed him liberally with some good prepared bird-food, keep him clean and quiet, and nature will do the rest. For steady feeding give mixed seed, two parts rape to one of canary. Give a little fresh lettuce every day, a bit of apple three times a week. Wash the cage floor, bath, and so on, every morning. Put in fresh gravel three times a week. Use the regular bird-gravel if you can get it. If not, clean, sharp river gravel, almost as fine as sand will do. Once a week, give a feed of hard-boiled egg, taking care to remove it before it becomes stale. In place of it you may with advantage, sometimes give bread soaked in new milk and squeezed nearly dry. A cleft pepper-pod hung at the side of the cage, is a help to both appetite and digestion. So is a spray of pepper-grass, taking care not to let it hang too long. If your bird is hoarse, soak the pepper-pod in milk and let birdie eat and drink of the combination.

As you love your bird, keep him away from draughts. They are as deadly almost as cats, and even more cruel. Hang your cage outside, not in he window, first putting a shade over the top of it. Sunshine is an excellent good thing for your pet, but the rays must not beat too long nor too full upon his feather cap. Never leave him over night up toward the top of a room in which gas jets have been burning. Hot, foul air always ascends, and will make short work of him in much less than a night. In hot weather give him a bath every day. In cold, every other day is better. No matter what the season, be sure that he has a sheltered place to get dry in. Every year bronchitis slays its thousands, yea, tens of thousands, and more than half contract it by perching in a draught while damp.

With the right sort of gravel, cuttle-fish bone is not absolutely essential. It is very well though, to keep a bit within reach. Take care though that nothing eatable corrodes the wires. Verdigris is the result—a potent poison for birds and men.

The finest singing birds are brought over from Germany. It is, however, entirely and easily possible to raise very good ones from imported stock. Choose birds of different strains, give them a big cage with a gourd or cocoanut shell swung in one corner, and warmly lined with wool and hair. When the birdlings come out of the shell, put in a plentiful supply of cracker and hard-boiled egg grated and mixed in equal quantity. It must be prepared fresh twice a day, as it sours easily, and is then poison to the tender nestlings. Leave both parents to care for them until they are feathered and can go into a cage of their own, when the old folk will probably set up a new family at the old stand.

Young birds begin to sing at about four months old. The full voice comes at seven or eight. As soon as they begin to chirp and twitter, borrow, buy or steal a fine songster, put him with them in a room to themselves, but in separate cages, and see how they will give him the sincere flattery of imitation.

Next to draughts and improper feeding, vermin are the roots of all the ills bird-flesh is heir to. For each, prevention is the best cure. Bird lice harbor in the cage itself by daylight. Oil of any sort is death to them. If you have reason to suspect them take your bird out of the cage, wash and scald it thoroughly, then oil all the top with sweet-oil or good fresh lard.

If your bird droops and lacks appetite, put a rusty nail into his drinking fountain, and mix a little coarsely-powdered charcoal with the gravel on his floor. Take thought for him in sharp changes of weather. Give him shade and air when the thermometer goes up to ninety. Throw a blanket over the cage when it gets toward freezing. Keep him as nearly as possible at the Irishman's "middle extreme" and your portion shall be morns of music, days of joy.

*In the *Ladies' Home Journal.*

GRANDPA GROWLS AT THE GIRLS.

Good land o' Goshen, what won't gals
Be up ter next, I wonder;
Thar's nuthin' they can't turn their hands
An' tongues ter now, by thunder!
Thar's no persimmon hangs so high
But they're jes' bound to fetch it,
No kind o' craze er-goin' round
But they're dead sure ter ketch it!

Thar's nuthin' they won't tackle now,
From politics to preachin';
No hide-bound wall, no prejudice,
But they will make a breach in.
O woman's brain is pannin' out
Some mighty big bonanzas!
To-day she rides a horse astride,
And runs a town in Kansas.

She's trainin' down almighty fine
To best the man, her master;
She's takin off her petticoats
So she can run the faster.
She thinks once she's cut loose from old
Convention's fatal fetter,
Thar's nuthin' that a man can do
But she could do it better.

Wal, let her try for all she's wuth—
Thar ain't no law agin it!
Whatever God's great scheme may be
We know that she is "in it."
It seems like flyin' in the face
Uv Providence, tho', when folks
Who're females can't be told by dress,
Nor ways nor works from men-folks!

Be politicians ef you must,
Pull wires an' work the caucus;
Or take the stump an' talk until
Your voices all are raucous;
I don't care shucks how big a pond
Your sex preempts to swim in;
But gals, for heaven's sake, don't forgit
Your best holt's bein' women!

—*Boston Globe.*

SAVING OURSELVES.

BY MARION WASHBURN.*

Do you know I am tired of the talk of economy, of saving eggs and milk, butter and flour, and to-day I mean to talk of something else.

It is all right and good to save, why, yes; "*economy is the road to wealth,*" they say, but there is one way of saving that is not decently practical among us; that is, saving ourselves. Supposing some morning we are overburdened with work; it seems impossible to get the least chance to make a cake for supper; must we force our weary frame on, after needful work is done, just to please some one's taste for cake?

Tea for this one evening can be enjoyed without and those moments saved, be devoted to rest. It is so pleasant after a hard morning's work just to lie quietly down for an hour and let time go by at its own sweet will. "But dear me," says Mrs. Fussall, "I must sew every spare minute, or the children won't have a decent thing to go to school in. I'm sure I don't want them laughed at."

And so the poor, mistaken soul tucks and ruffles and stitches all the afternoon, with a terrible pain in her side, and a great longing just to lie out in the hammock under the trees and never see a needle and thread. By-and-bye there will be a mysterious dispensation of Providence around there, and somebody else will have to ruffle and fret over the children and their clothes.

Then there is such a thing as being too saving for our own good. Little Alice Joles has a terrible cough, and goes shivering all winter in an old shawl, and without overshoes. When I remonstrate, as long friendship gives me the right to do, she sighs mournfully:

"Well, William is so anxious to raise money to buy us another cow before spring, so I went without a cloak and my new winter's dress I had chosen, and as for overshoes, they cost about a dollar and a half—good ones I mean—and he thought I didn't go out enough to need them." Her lip quivered a little as ——!

* In the *Ladies World.*

she tried to hide the thin shoes under her scant skirts.

Now it happened that I had seen "William" pay twenty dollars for a fresh overcoat when he had a good one, and buy a box of fine cigars "just to treat my friends," and I'm afraid I gave her a few remarks not exactly like Paul's in relatien to the duties of wives to their husbands. If a woman does not look after her own needs, no one else will, and she has no business to shorten the few appointed days she does have, for the sake of saving anything.

It is usually saving money for John's second wife to enjoy. Life will be just as happy if sheets, towels, common underwear, etc., are just carefully slighted when we iron.

The washing will be just as white in freezing weather if it is only rinsed once after leaving the boiler. Dinner will be just as good if it ends with a "warmed over" pie instead of a fresh baked one for every day. Indeed, I know a man who requires his wife to bake every morning because he couldn't possibly eat an old pie; and another thing he insists on is two or three large jars always full of fruit cake, white cake, cookies and knick-knacks for his hungry streaks *between meals*. She is slowly wearing out, tired of the tread-mill. Now, I don't mean to insinuate that men are always to blame for a woman's foolishness; there are some who will not rest in any way.

One woman will scrub an old out-kitchen every day, even if she dies for it, while a pantry shelf is just disgraceful with dust and moldy crumbs.

Now, sisters, we must make the most of our life, and if it is all spent in one endless, busy drive of daily work without thought of saving our precious selves once in a while, we only are to blame if we become old and broken down in health long before our time.

Let us save ourselves even at the expense of a few dollars once in a while.

FROSTS AT LIFE'S SUNSET.

Dr. De Witt Talmage speaks on this subject as follows,

You may have noticed at this time of the year that some trees, at the first touch of the frost, lose all their beauty; they stand withered, and uncomely, and ragged, waiting for the northeast storm to drive them into the mire. The sun shining at noonday gilds them with no beauty. Ragged leaves! Dead leaves! No one stands to study them. They are gathered in no vase. They are hung on no wall. So death smites many. There is no beauty in their departure. One sharp frost of sickness, or one blast off the cold waters, and they are gone! No tinge of hope! No prophecy of Heaven! Their spring was all a-bloom with bright prospects; their summer thick-foliaged with opportunities; but October came, and their glory went. They were frosted! In early autumn the frosts come, but do not seem to damage vegetation. They are light frosts. But some morning you look out of the window and say: "There was a black frost last night;" and you know that from that day everything will wither. So men and women seem to get along without religion, amid the annoyances and vexations of life that nip them slightly here, and nip them there. But after awhile death comes; it is a black frost and all is ended! Oh, what withering and scattering death makes among those not prepared to meet it! They leave everything pleasant behind them—their house, their families, their friends, their books, their pictures—and step out of the sunshine into the shadow. They hang their harps on the willow; and trudge away into everlasting captivity. They quit the presence of bird, and bloom, and wave, to go unbeckoned and unwelcomed. The bower in which they stood, and sang, and wove chaplets, and made themselves merry, has gone down under an awful equinoctial. No funeral bell can toll one-half the dolefulness of their condition. But, thank God, that is not the way people always die! The leaves of the woodbine are never so bright as they are in late autumn. So Christian character is never so attractive as in the dying hour. Such go into the grave, not as a dog, with frown and harsh voice, driven into a kennel, but they pass away calmly, brightly, sweetly, grandly! Like the sunset of a beautiful autumnal day, they slowly and gently sink behind a bank of rest.

THE WOOING ART IN PORTUGAL.

The Portuguese are very conservative in their ideas of the position of women in society, and they got their ideas from their Moorish masters in bygone centuries. Consequently girls are shut up like nuns and they are hard to get at, says the Chicago *Tribune*. They go regularly to mass Sunday mornings and take occasional walks during the week always accompanied by one or two chaperons. Young men never call at the house, and, if they did would not be admitted "except on business." This strictness leaves but one way open for an interchange of sentiments, and that is the window, and it is quite the thing to make use of it. It is not considered ill-bred to stare in Portugal; a man may stare at a girl he does not know as long as he likes; he must not do so to a girl he has been introduced to unless she gives him some encouragement by returning his glances. A girl will sit at her window all the afternoon looking into the street, and her adorer from the street looks at her, and this is so much the custom that it attracts no attention from passers-by. From looks they proceed to bows, to smiles, a few words, then he follows her to church, finds out if she is going to the theatre, and goes too serenades her with his guitar on moonlight nights and finally makes an offer to her father. He is then received by the family, and allowed to come to the house in a quiet way until the wedding, and after that the young couple usually live with her parents or his, and the even tenor of their life continues.

A WOMAN INVENTS A CAR-COUPLER.

Mrs. George Bowron, wife of the well known musician, is the inventor of a car-coupler for which it is claimed that it is simple, and inexpensive, and practicable, and can be applied to any freight or passenger car now in use at comparatively small cost. Forward of the front truck is a half-elliptic spring. This spring holds the slide in the hollow draw-head and the slide holds the pin. When the link is shoved into the draw-head the pressure sends back the slide and allows the pin to fall. To uncouple an ordinary bar is used, with a crank handle, fastened on the side and near the top of the car. This bar is connected with the pin by a chain and the operation of it uncouples the car.

Railroad men speak highly of the appliance and several railroad companies are now figuring on adopting and making use of the patent; and a trial will shortly be made with the new coupler attached to old freight cars. Mrs. Bowron said recently:

"This is the result of ten years' labor. All the railroad men who have examined my model are delighted with the coupler and say the use of it will add 14 years to the life of every freight car on which it is used and do away with the jar which the present mode of coupling always occasions.

Mrs. Bowron is a native of Santiago, her maiden name being Azalia Farasa Vallade. When she was 10 years old she was sent to the country to be educated and for five years studied at the Northwestern University.

GOOD ADVICE FOR GIRLS.

In an address to a class of girl graduates Kate Field gives the following advice full of common sense:

Let me ask whether you are good housekeepers. Can you cook? If not, in the name of common sense, of the man you propose to marry, of the friends who may visit you, of an innocent posterity, don't rest until you have learned the business of almost every woman's life, which is to keep house well and economically.

I do not hesitate to affirm that this republic, great as her necessities are in many directions, needs cooks more than all else. The salvation of the national stomach depends upon them. We are a nation of dyspeptics, and Americans are dyspeptics because they eat the wrong foods, badly cooked, which they drown in ice water. They are dyspeptics because our women don't know the rudiments of their business and resign their kitchen into the hands of incompetent servants of whom they are afraid and whose impudence they frequently endure through sheer helplessness. Of what use a smattering of French and music, of what avail even a profound knowledge of something worth acquiring, if unable to face the awful and universal problem of servantgalism and solve it by mastering it?

COOKING.

"Cooking," says an authority who knew, "is really a chemical process," but few are the cooks who understand and appreciate this fact; not one in a thousand, probably, says Alexis in the *Ladies' World*. Cooking consists of various operations, any or all of which when properly done, prepares the food for easier treatment by the digestive processes. The main reason that there is such poor cooking is that women, as a rule, do not know what *amount* of heat is really required to bring about the desired changes in the raw material. Very few women know, for instance, that all stewing must be carried on gently, placing, wherever possible, one vessel within another, the outer one containing the boiling water. But few cooks know the value of steaming meat, fish and certain vegetables, though many are in the excellent habit of steaming puddings. Frying is very much decried and with good reason, because it is so rarely done properly. Frying should always be done in covered pans, and the meat should never be put in the pan until the fat is boiling hot. The heat should be quick and steady, then, if it has been covered during the operation, the meat will be tender. In the so-called roasting, all meat should be covered so that the joint will come to table brown and tempting, juicy, but well done. The proper result of cookery should be the bettered condition of the food, and this is only to be obtained by the uniform action of heat on every layer of fibre. Broiling is best done with a broiler, which is contrived so as to save the valuable juices of the meat, and also to broil with less speed, that is, to broil over a moderate fire. Baking needs a uniform but not excessive heat.

One of the main points in cooking should be to preserve the fluid constituents of food to a certain degree, and not to dry them up by excessive heat. Moisture is required in food, and therefore should not be got rid of entirely, as such a proceeding spoils the food, and gives rise to a peculiar thirst which it is difficult to quench.

SOME USES OF HOT WATER.

Hot water is far more of a medicinal property than many believe or know. Because it is to be had for the making thousands think it invaluable, on the theory that what comes easiest is ofttimes least thought of. The uses of hot water are, however, many:

For example, there is nothing that so promptly cuts short congestion of the lungs, sore throat, or rheumatism, as hot water when applied promptly and thoroughly.

Headache almost always yields to the simultaneous application of hot water to the feet and back of the neck.

A towel folded several times, and dipped in hot water, and quickly wrung out and applied over the toothache or neuralgia, will generally afford prompt relief.

A strip of flannel, or napkin folded lengthwise, and dipped in hot water and wrung out, and then applied round the neck of a child that has the croup, will sometimes bring relief in ten minutes.

Hot water taken freely half an hour before bedtime, is helpful in the case of constipation, while it has a most soothing effect upon the stomach and bowels.

A goblet of hot water taken just after rising, before breakfast, has cured thousands of indigestion, and no simple remedy is more widely recommended by physicians to dyspeptics.—*Ladies' Home Journal*

RIVETING BY ELECTRICITY.

It seems to be demonstrated that the new method of riveting by electricity is a remarkable success, and will take its place among the most important improvements in the industrial arts. The apparatus comprises a transformer, the primary of which is formed of a heavy copper bar, laid parallel to a coil of fine wire, and over the two are clamped two angular segments of iron, forming, when united, a complete iron shell, which is claimed to increase the efficiency of conversion. The structure creates a current of great volume in the copper bar. In the ends of this bar are mounted an anvil, provided with a regulating screw for moviug it up or down and follower provided with a screw. In the circuit of a primary is placed a choke coil provided with a regulating switch for cutting in more or less of the coil by which the strength of the current induced in the secondary map be controlled. The bars or pieces of metal are placed upon the anvil and the rivet dropped in place, the anvil being then screwed up until the plates of metal are firmly held below on it and the two insulating legs secured to the upper limb of the copper bar. The face of the bar is covered with insulating material, except at a central point where it is left bare, and, when forced against the rivet, the latter establishes connection from the upper limb, the current developing sufficient heat to make an upsetting of the rivet shank easy under the pressure of the screw.

SEAMLESS STEEL TUBES.

The manufacture of seamless steel tubes has made rapid strides in Birmingham within the past few years, says *Iron*. Wherever metal tubing is required to withstand a great strain, and where the use of steel is permissible, the seamless tube is in growing request. Its invention has added materially to the efficacy and applicability of hydraulic machinery, as a ¾-inch tube with a core of ½-inch, capable of withstanding a pressure of 1,000 lb. on the square inch, can be drawn in steel. It is also being largely used for boilers instead of copper tubing, the cost being less, while its life is as long, and when made of the best material, seamless steel tubing is more reliable than ordinary copper boiler tubes. Messrs. Shorthouse, Birmingham, having acquired about an acre and a half of freehold land adjoining their mills, have erected upon this site the Paragon Works, which are very near completion. The works are of the most modern type, and are fitted with special machinery for the manufacture of these tubes. Success in the manufacture of seamless steel tubes depends on two factors. The first is the employment of the very finest steel procurable; steel which is thoroughly homogeneous, and possessing a high ductility and tenacity, being requisite. Unless the steel is of uniform quality throughout, the tubing is sure to be variable, and though seamless tubes can be made from English ingots, the most reliable material for evenness of character is Swedish charcoal steel. This is the metal which will be used exclusively in the manufacture of these tubes by Messrs. Shorthouse. Its high tenacity admits of its being drawn very fine without weakening the fiber, and tubes can thus be obtained of very light weight combined with great strength. The second factor is the use of machinery which will draw the metal with perfect truth and steadiness. In order to attain this object Messrs. Shorthouse have put down a couple of twin tandem compound condensing steam engines, capable of developing 500 indicated horse-power. These engines are guaranteed to work at a consumption of 2¼ lb. of coal per indicated horse-power per hour, the power being generated in four Galloway boilers. The driving wheel weighs 28 tons. The cogs and gearing are shallow, V-shaped, and are machine-moulded. A perfect shallow V-shaped cog, carefully moulded and finished, greatly reduces the vibration, and so admits of the power being applied to the draw benches on which the steel billet is drawn out with the most perfect smoothness, and yet slowly. so as neither to strain the metal nor interfere with the form of the tube. The draw benches are driven by a geared steel shaft, 12 inches in diameter, one gearing working the benches at twice the speed of the other. At present there are two pairs of rolls laid down together with improved drilling machinery. There is also a complete set of muffle furnaces of the newest design for annealing the tubes. When in working order the factory will be one of the most complete and powerful of its kind in the country.

LITERARY.

The Irrigation Age for October 1st is a number of very unusual interest and importance. It consists of nearly sixty pages, generously illustrated. One single feature of this number renders it indispensable to every irrigator and investor in irrigation enterprises. This feature is its complete illustrated account of the Irrigation Congress, which occupies sixteen pages of the *Age*. This is something which should be widely read and preserved. Besides this, the *Age* will contain details of the coming campaign for the session of the arid lands, an account of the organization and membership of the new American Association of Irrigation Engineers, a description of the first sugar factory in the world which depends on beets raised by irrigation, the usual full departments of irrigation news, farm and orchard papers, and other attractive reading. This addition of the *Age* consists of 25,000 copies, it is said. It will be found on all the news stands, and orders for extra copies should be promptly forwarded to either its Denver or Salt Lake offices.

A Girl in the Karpathians.

The most delightful book of the season is Miss Menie Muriel Dowie's "Girl in the Karpathians," published by the Cassell Publishing Co., of 104 Fourth avenue, New York. Price $1.50. The author is a Scotch lassie of only twenty-four summers. One of those summers she passed as a holiday in the highlands of Eastern Galicia, and the book referred to is the story of her sojourn there. Miss Dowie is certainly a brave and venturesome young woman: armed with a small revolver, and having only a hired guide for her sole escort, she tramped through a strange country, forded rivers, climbed mountains, slept on the boughs of trees, descended a mountain torrent on a raft of logs, and "roughed it" generally in a way that would have made many a strong man tired. She saw nature face to face, so to say, and in writing her book this courageous Scotch woman is wholesomely original. By following her story, one feels that he sees what she saw, and travels in her footsteps. Those who have not traveled abroad the past summer, can experience the pleasant sensations of a venturesome journey (free from its dangers) by securing "A Girl in the Karpathians."

BUSINESS TRANSACTIONS.

A 100 h. p. tandem compound engine, manufactured by The Ball Manufacturing Co., Erie, Pa., is to furnish the power for the new electric road being built by the Beatrice Rapid Transit Co., Beatrice, Neb.

The Ball Engine Co , Erie, Pa., shipped the Buffalo Street Railway Co., a few days ago, a 300 h.p. cross compound engine, being the fourth of the same size built by them for the Buffalo Street Railway Co.

J. W. Parker & Co., Philadelphia, Pa., representatives of the Ball Engine Co., Erie, Pa., are installing a 100 h.p. engine built by that company in the station of the Citizens' Electric Illuminating Co., Pittston, Pa.

The California Electric Light Co., San Francisco, Cal., are adding to their already immense power plant a 300 h.p. cross compound engine built by The Ball Engine Co., Erie, Pa.

M. F. & F. C. Sayles are installing an isolated electric light plant. A 35 h.p. engine fulnished by The Ball Engine Co., Erie, Pa., supplies the necessary power.

The Falconer Manufacturing Co., Falconer, N. Y., have purchased a 150 h,p. engine for running electric light and for operating their works. The engine was manufactured by The Ball Engine Co., Eric, Pa.

The Wheeler Condenser & Engineering Company has recently filed articles of incorporation with the Secretary of State at Trenton, N. J. The company has bought the entire plant and business of The Colwell Iron Works, at Carteret, N. J., which is one of the largest concerns in this country manufacturing vacuum pans, and special machinery for sugar refineries, salt works, condensed milk factories, etc. The Wheeler company will continue to manufacture Wheeler's patent surface condensers and other of Mr. Wheeler's specialties. The capital stock of the company is $300,000, and the incorporators are as follows: Frederick Meriam Wheeler of Montclair, N. J., Aaron Vanderbilt, of New York City, Clifton H. Wheeler of Brooklyn, N. Y., William H. Hampton of New York City, and Charles W. Wheeler of Brooklyn, N. Y. The headquarters of the company will be at 92 and 94 Liberty street, New York City.

The Smith Premier typewriter has received the highest award at the State Fair, Sacramento; also at the Mechanics' Exposition, San Francisco. The "Smith Premier" puts all other typewriters in the shade.

J. Elliot Shaw & Co., of 632 Arch street, Philadelphia, whose double armature heavy stroke electric bell was illustrated in one of our recent issues, will be glad to furnish any information desired about electric bells.

The Mason Regulator Co., of Boston, who are "headquarters" for steam regulating devices, have issued a picture of their handsome stenographer, who merrily sings "Little Annie Rooney is my sweetheart." while she is hammering away at her typewriter acknowledging orders received by the Mason Regulator Co.

CHICAGO, MILWAUKEE & ST. PAUL RAILWAY.

Electric Lighted and Steam Heated Vestibuled Trains, with Westinghouse Air Signals, between Chicago, St. Paul and Minneapolis, daily.

Electric Lighted and Steam Heated Vestibuled Trains between Chicago, Council Bluffs and Omaha, daily.

Through Vestibuled Sleeping Cars, daily, between Chicago, Butte, Tacoma, Seattle, and Portland, Ore.

Solid Trains between Chicago and principal points in Northern Wisconsin and the Peninsula of Michigan.

Daily Trains between St. Paul, Minneapolis and Kansas City via the Hedrick Route.

Through Sleeping Cars, daily, between St. Louis, St. Paul and Minneapolis.

The finest Dining Cars in the World.

The best Sleeping Cars. Electric Reading Lamps in Berths.

6,100 miles of road in Illinois, Wisconsin, Northern Michigan, Iowa, Minnesota, Missouri, South Dakota and North Dakota.

Everything First-Class.

First-Class People patronize First-Class Lines.

Ticket Agents everywhere sell Tickets over the Chicago, Milwaukee and St. Paul Railway.

WATERWORKS CONTRACT.

Butler, Indiana, lets a contract for constructing its waterworks, Oct. 19, 1891.

SITUATION WANTED

As engineer, by a thoroughly experienced and reliable man, highly recommended. Address "Steam," care of The American Engineer, 1302 Pontiac Building, 358 Dearborn street, Chicago.

Map of the United States.

A large, handsome map of the United States, mounted and suitable for office or home use, is issued by the Burlington route. Copies will be mailed to any address on receipt of 12 cents in postage by P. S. Eustis, Gen'l Pass. Agent, C., B. & Q. R. R., Chicago, Ill.

NEW! NEW!

FOR MANUFACTURERS.

Who wants to buy a small new machine for imitation and exploration in America. Sole machine in the world of first necessity for manufacturers of chocolate, and patented only in Europe. Please address offers, if possible in German, to C. N. 27850, care Rudolf Mosse, Berlin, S. W. (Germany).

CONTRACTS OPEN.

United States Engineer Office, 34 West Congress street, Detroit, Mich., September 19, 1891. Sealed proposals, in triplicate, will be received at this office until 2 o'clock p. m., October 19, 1891, and then opened: For furnishing ten gate anchorages for the 800 feet lock at St. Mary's Falls Canal, Michigan. Preference will be given to materials of domestic production or manufacture, conditions of quality and price (import duties included) being equal. Attention is invited to Acts of Congress, approved February 26, 1885, and February 23, 1887, vol. 23, page 332, and vol. 24, page 414, Statutes at Large. The government reserves the right to reject any or all proposals; also, to waive any informalities. For further information apply at this office. O. M. Poe, Colonel Corps of Engineers, Bvt. Brig. General, U. S. A.

Heating and Ventilating Apparatus. — Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock p.m. on the 12th day of October, 1891, for all the labor and materials required for putting in place complete the new low pressure, return circulation steam heating and ventilating apparatus for the U. S. Courthouse and Post Office Building at Portland, Me., in accordance with drawings and specifications, copies of which may be had at this office or the office of the custodian of the building at Portland, Me.

Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal.

The department will reject all bids received after the time herein stated for opening the same; also bids which do not comply strictly with all the requirements and meaning of this invitation.

Proposals must be inclosed in envelopes, sealed and marked "Proposals for the New Low Pressure, Return Circulation Steam Heating and Ventilating Apparatus for the U. S. Co rthouse and Post Office Building, at Portland, Me.," and addressed to W. J. Edbrooke, Supervising Architect.

OCTOBER 17, 1891. **The American Engineer.** VOL. 22, NO. 16.

FRANKFORT ELECTRICAL EXPOSITION.

The Frankfort Electrical Exposition is Germany's fore-runner of the electrical section of the Columbian Exposition. And arrangements are being made to ship those trans-Atlantic exhibits from the Main to Chicago.

The accompanying illustration gives a good view of the electric machines as arranged in the "Machinery Hall" at Frankfort. Different views are being presented in various papers, but the one shown on this page (by courtesy of our neighbor *Electricity*) seems as good as any, including some of the decorations.

Thus far the Frankfort Exhibition has been a very successful one. The feature which has attracted the special attention of electricians is the long distance over which the electric current has been transmitted—about as far as one-fourth the distance between Niagara Falls and Chicago. The experiment has thus far been successful, but it has been done in fine dry weather; what rain and moist atmosphere may do to mar this long distance transmission of electricity remains to be seen.

Anyway those in charge of the electrical department of the World's Fair are not likely to let the Germans continue as champions of the long distance scheme; and already the proposal to utilize Niagara's force to generate electricity and transmit it to Chicago—a distance of about 500 miles— is being seriously considered.

When Columbus was made a prisoner in San Domingo the governor who arrested him feared there might be an attempt at rescue. So he trained a big gun on the entrance of the citadel, or castle, in which Columbus was confined. That cannon has lain in the same place ever since until now, when Mr. Ober, a World's Fair representative, recovered it, and with the permission of the governor of San Domingo, brought it to the United States. It has been shipped to Chief of Construction Burnham in order that he may use it in some way in ornamenting the Exposition grounds.

SOLID EMERY WHEELS.

The Tanite Co., Stroudsburg, Pa.

GENTLEMEN:—At your suggestion, we, the undersigned, associated ourselves in an enquiry as to the comparative value of the solid emery wheels made and generally known in the United States. Our first object was to settle the question as to what constitutes a good solid emery wheel. Our second object was to establish test conditions of such scientific accuracy as to prevent any doubt of the results. Our third object was to give thorough trial, under uniform test conditions to the various wheels, and to secure a mass of exact data. The investigation thus outlined has been of the most painstaking and thorough character, has cost some thousands of dollars, and has lasted about two years.

Having determined on the qualities which constitute a good solid emery wheel, we established our own conditions of test, and submitted to such conditions wheels of our own selection. The wheels of fifteen different manufacturers were selected. These were: Celluloid, Crystal, Detroit, Grant, Hampden, Lehigh, Norton, Northampton, Norwich, Sterling, Tanite, Union Stone, Vitrified, Vulcanite, Waltham.

Among these fifteen varieties only one compared favorably with the Tanite wheel, the latter having easily beaten all competitors save one. The comparative values of the Tanite and its one rival will have to be ascertained by further trials.

After many preliminary trials with a special machine its results were compared with those obtained by individual operators under various conditions, and experiments with skilled workmen, expert grinders, were made.

It was agreed, that to constitute a good solid emery wheel, the following qualities should be combined: safety under the widest conditions of use and misuse; rapidity of cut; freedom of cut at moderate pressure; reasonable amounts of wheel loss and power consumption; evenness of wear; general staying quality; and reliability under the widest range of circumstances.

Our report is based on a long series of trials at three different pressures—42 lbs., 60 lbs. and 100 lbs. These separate trials numbered several thousand, during each of which exact data were recorded as to speed, power, resistance between wheel and metal, amount of metal ground off, amount of wheel material consumed, and observations made as to the cleanness of cut, amount of heat generated, amount of glazing or clogging up of wheel with metal, and as to cracks, breaks and defects of wheels.

Of the fifteen varieties six were found too unsafe to warrant their general use, 57 per cent. of the wheels bursting under the same conditions which other wheels passed through uninjured. Eleven varieties (among which are included the six unsafe varieties) were found to be such slow cutters that the average metal removal of ten of them was less than the general average of all the wheels. Of the fifteen varieties only four were found to be rapid cutters. Of these one wore so rapidly that the cost of its rapid cut was unreasonable. This left three, safe, effective and satisfactory wheels, one of which, however, was demonstrated to work at a greater cost than the Tanite. The rivalry was thus narrowed to two wheels, and, in the judgment of our board, further trials are necessary before the relative value of these two can be determined.

One striking feature characterized these two. That is, that in every series of trials these wheels increased in productive capacity, the average of the last cuts of all the series being greater than the average of all the first cuts. The thirteen other varieties all decreased in productive capacity, the average of the last cuts being less than the average of the first. Some of these which made a brilliant show at the start cut scarcely anything at the close.

Our investigation satisfied us that the ordinary user of solid emery wheels is likely to be deceived as to the productive capacity of such wheels and the cost of product if he trusts to mere appearances, and that the real value of any solid wheel can only be fixed by an investigation which gives exact data and covers a wide range of observation. Such an

VIEW OF "MACHINERY HALL," FRANKFORT ELECTRICAL EXHIBITION.

investigation ours has been,each fact being observed and attested by several independent witnesses trained to scientific observation, and each calculation and measurement being passed through and checked by several hands.

As nearly all the preliminary and collateral trials were made with Tanite wheels more than three times as many of these were used as of any other make. In all this use, under every degree of measured automatic pressure and under the heavy pressure of long bars used by hand (a test applied to no other wheel) and also at a speed nearly double that of any other wheel save one, not a single wheel burst. The Tanite wheel cut well at moderate pressure, and in using it the workman's task is an easy one. The consumption of power and of wheel material is such that, taking into account the cost of abor and all other items entering the problem, the Tanite wheel does its work at a very low cost.

As evidence of these facts, thus summarized and stated in a general manner, we possess an overwhelming mass of exact data in the form of numerical tabulations. These details are reserved for future publication, and we content ourselves now with this brief report, and with a still briefer abstract for the use of hasty readers.

Coleman Sellers.
J. E. Denton.
Alfred R. Wolff.

Lieutenant A. C. Baker, World's Fair commissioner to Mexico, reports that the government of Mexico will participate in the grand military display and encampment that is to be held at Chicago on Oct. 12, 1892, and that the crack regiment of the Mexican army will be seen in full numbers. Lieutenant Baker also reports that among the other attractions of the Mexican exhibit at Chicago in 1893 will be a fine band and company of rurales (as the picturesque militia of the mountain districts are known), a troop of the engineer batallion, a typical Mexican orchestra, an Aztec village, moulders in clay from Guadalajara, a Mexican garden and a miniature of the Valley of Mexicos.

EAST END ELECTRIC LIGHT COMPANY'S STATION, PITTSBURGH, PA.

In 1886 the East End Electric Light Company, of Pittsburgh, Pa., commenced operations with three small engines, of different makes, and direct-current dynamos.

The engines were placed in competition with each other, and with the understanding that the successful one should excluude the others and insure for its manufacturers the favor of future orders.

After conclusive tests, it is said, the Westinghouse engine was adopted as best suited for the work, and in one form or another has since furnished all the power for the plant.

The demand for electric service increased almost immediately beyond the limit of the supply, and forced the company to build a new and larger station.

During the succeeding five years the development has been unusually rapid, even for an electric light plant, and has caused extensive additions to be made. At present (and still increasing) the plant consists of:

ENGINES.

Two 18 and 30x16	Westinghouse	compound	250 h.p.
Three 11 and 19x11	"	"	80 "
One 18x16	"	standard	200 "
Three 15, ½x14	"	"	150 "
Four 12 x11	"	"	80 "
One 11x10	"	"	65 "
One 7½x7	"	"	25 "

Total 15 engines, aggregating 1,800 h.p.

DYNAMOS.

Three 2,500 light Westinghouse alternating current incandescent.
Three 1,500 light Westinghouse alternating current incandescent.
One 500 light Westinghouse direct current exciter.
One 100 " " " " "
Twelve 35 " Waterhouse arc.
One 60 " Westinghouse alternating current arc.
Total, 21 dynamos, aggregating 12,000 incandescent and 480 arc lights.

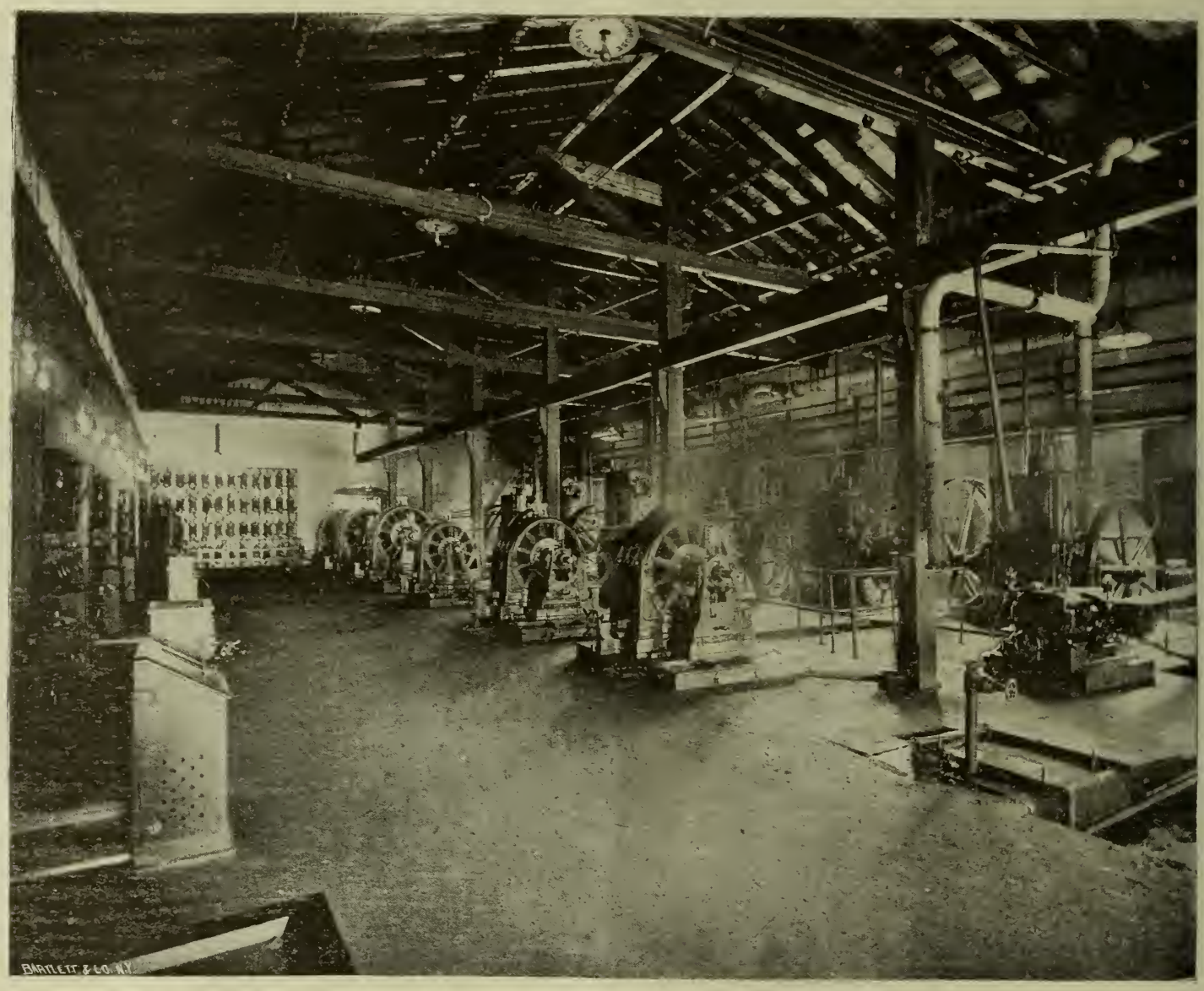
The two accompanying interior views of this station will give an excellent idea of the arrangement of the machinery.

Section No. 1 is devoted to incandescent lighting alone, while section No. 2 is used exclusively for arc lighting. Both sections still show room for improvement.

A traveling crane facilitates the shifting of the lighter arc dynamos, but where it would seem to be most needed—over the engines and heavy incandescent machines—nothing of the kind is yet in place.

A continuous steam pipe would be a great convenience, and the disposition of the engines will readily allow such a construction in lieu of the present three independent steam mains arrangement.

In general, while the plant is well designed, it is evident that the rapid growth has interfered to a great extent with a corresponding increase in the commercial economy.



East End Electric Light Company, Pittsburgh, Pa. (Section No. 1.)

The Department of Public Instruction of North Dakota has undertaken to secure an exhibit which will adequately represent the educational facilities of that state. It has issued to teachers and county superintendents a strong circular containing an explanation of the enterprise in hand, various regulations to be observed, and a "Manual of Work for the World's Columbian Exposition Course for Teachers and Reading Circles."

The Massachusetts building at the Exposition will be modeled after the historic old Hancock house, which stood on Beacon street, Boston, for fully 125 years. Built by his uncle in 1737, this mansion was occupied by John Hancock, the signer of the Declaration of Independence, when Governor of Massachusetts, and there he entertained Washington, Lafayette, and many other distinguished Revolutionary patriots. Massachusetts will spend $35,000 or $40,000 in imitating, at the World's Fair this famed mansion. The building will be used almost exclusively as a state headquarters and club house.

LOCALIZATION AND REMEDY OF TROUBLES IN DYNAMOS OR MOTORS.—IV.

By Prof. Francis B. Crocker and Dr. S. S. Wheeler.

Continued from page 143.

IV.—HEATING OF BEARINGS.

1st Cause.—*Lack of oil.*

Symptom.—Shaft and bearing look dry. Shaft usually turns stiffly. Oil cup or reservoir empty.

REMEDY.—Supply oil, and also make sure that oil passages as well as feeding or self-oiling devices work freely, and that the oil cannot leak out. This last fault sometimes causes oil to fail sooner than attendant expects.

2d Cause.—*Grit or other foreign matter in bearings.*

Symptom.—Best detected by removing shaft or bearing and examining both. Any grit can of course easily be felt, and will also scratch the shaft.

REMEDY.—Remove shaft or bearing, clean both very carefully and see that no grit can get in. Place motor in dustless place or box it in.

3rd Cause.—*Shaft rough or cut.*

Symptom.—Shaft will show grooves or roughness, and will probably revolve stiffly.

REMEDY.—Turn shaft in lathe or smooth with fine file and see that bearing is smooth.

4th Cause.—*Shaft and bearing fit too tight.*

Symptom.—Shaft hard to revolve by hand.

REMEDY.—Turn or file down shaft in lathe, or scrape or ream out bearings.

5th Cause.—*Shaft "sprung" or bent.*

Symptom.—Shaft hard to revolve and usually sticks much more in one part of revolution than in another.

REMEDY.—It is almost impossible to straighten a bent shaft. It might be turned true but probably a new shaft will be necessary.

6th Cause.—*Bearings out of line.*

Symptom.—Shaft hard to revolve, but is much relieved by loosening screws which hold bearings in place. Bearing sometimes moves perceptibly when loosened, even when motor is not running, and belt is off.

REMEDY.—Loosen by partly unscrewing bolts or screws holding bearing in place, and find its easy and true position, which may either require it to be moved sideways or up and down; then file the screw holes in the bearings or raise or lower the bearings, as may be necessary, to make them occupy right position when screws are tightened.

7th Cause.—*Thrust or pressure of pulley collar or shoulder on shaft against one or both of the bearings.*

Symptom.—Move shaft, while revolving, back and forth with the finger or a stick applied to the end, and note if collar or shoulder tends to be pushed or drawn against either bearing. A dynamo or motor shaft should always be capable of moving freely back and forth a sixteenth or eighth of an inch to make commutator and bearings wear smooth (See Sparking No. 3). If this does not occur it should be relieved in one of the following ways:

REMEDY.—Line up the belt, shift collar or pulley, turn off shoulder on shaft or file off bearing until the shoulder does not touch when running or until pressure is relieved.

8th Cause.—*Too great load or strain on the belt.*

Symptom.—Great tension on belt. In this case pulley bearing will probably be very much hotter than the other and also worn elliptical, in which case the shaft may be shaken in the bearing in the direction of the belt pull, provided the machine has been running long enough to wear the bearings.

REMEDY.—Reduce load or belt tension, or use larger pulleys and lighter belt or even gearing so as to relieve side strain on shaft.

9th Cause.—*Armature too near one pole-piece, producing much greater magnetic attraction on nearer side.*

Symptom.—Examine the clearance of armature and see if it is uniform on all sides. Charge and discharge the field magnet, the armature being disconnected (by putting paper under one brush), and see if armature seems to be drawn to one side and turns very much less easily when field is magnetized.

REMEDY.—This fault due to an inherent defect in the original construction, which is difficult to correct, but in cases of necessity the armature can be centered exactly in the field by moving the bearings, which may be done by carefully filing the holes through which the screws pass that hold the bearings in place, or the pole-piece may be filed away where it is too near the armature. It is sometimes possible to spring the pole-piece further away from the armature, but it is difficult and dangerous to attempt.

East End Electric Light Company, Pittsburgh, Pa. (Section No. 2.)

The American Engineer.

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TO WHOM IT MAY OONCERN.

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JEFFERSON YOUNG, JR.
Supreme Ohief Engineer A. O. of S. E.

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CONTENTS OF THIS NUMBER.

ENGINE cards with curiously shaped indications appear in this issue (on page 157). The engineer who sends them cannot make out what ails his engine, and will be glad of the views of various experts in reading indicator cards.

ELECTRIC power derived from a long distance is one of the special features of the Electrical Exposition at Frankfort-on-the-Main, Germany. An experienced electrician of repute now proposes that force from Niagara Falls should be transferred by means of electricity to Chicago for the Columbian Exposition. This scheme would eclipse the Frankfort "long distance" transmission of power business altogether, and cover a distance nearly four times as great.

WOMEN can take charge of locomotive as well as stationary engines, as seems from a report in our Women's Department this week. The female loco motive engineer now heard from seems to perform her work well. Miss De Bar, whose case was reported in our columns some months since, is a full-fledged stationary engineer, duly licensed, in Chicago. Her engine room is a model of neatness, and we are informed that she runs her engine very economically. She uses as much oil as is needed, without any running to waste, and her instructious to her fireman have reduced the coal bills far below what they were when a man was acting as engineer there.

THE DECAY OF APPRENTICESHIPS.

Such is the caption of an interesting article in an English contemporary, *The Ironmonger*, on a branch of training which has been in vogue in the Old World for centuries. And our transatlantic forefathers had no orthodox way of learning a trade or handicraft except by serving long years of apprenticeship. Prof. Sweet and others have recently been writing on this subject, or rather on the necessity of some system to make up for the absence of the apprenticeship system in America. The article in *The Ironmonger* is as follows:

In some quarters it is freely alleged that the system of apprenticeship is decaying, and that at no very distant date we shall witness its complete extiuction. This to some may seem to be a very bold and wild assertion, but it is put forward with much assurance, and is meeting with a considerable measure of acceptance. As regards the ironmongery trade, we are not disposed to admit that the allegation is true, although it appears to be beyond question, that the terms for which youths are bound apprentices nowadays are much shorter than they were formerly. There is also a more general disposition to "skip" the formality of indentures, and to give boys outdoor, instead of indoor, terms. No doubt these practices vary a good deal in different parts of the country, in the large towns, and in the rural districts. Generally speaking, however, there seems to be a prevailing impression that the system of apprenticeship is falling into disuse. If that were really the case on anything like a general basis there would, we think, be some reason for expressing apprehension respecting the future of many of our industries. The plan has been abused, no doubt, by tyrannical, greedy, or careless employers; but it is obvious that unless a youth is thoroughly well trained in a business or trade he cannot possibly become master of it. If apprenticeship is abolished, therefore, we fail to see what is to take its place. Very few youths "settle down" to a trade from the outset of their own accord, and it not uncommonly needs all the power conferred by duly-signed indentures to keep them within bounds, and zealous in the pursuit of their trade. In the absence of the apprenticeship agreement, therefore, there would certainly be constant changes on the part of the young men, who would become "jack-of-all-trades and master of none." There are, indeed, plenty of arguments in favor of some system of apprenticeship or probation, under which young men may acquire a full knowledge of a trade or business. Similarly, it is easy to find an abundance of reasons for the period of pupilage being made sufficiently extended to give the youth opportunities of completing his trade education. In the "good old times" seven years was almost universally fixed. Nowadays five and even three years are deemed to be sufficient. This reduced term may be, perhaps, owing to the late period of life during which boys are kept at school; but, even if it is, some think it goes without saying that so short a period as three years is totally insufficient for a youth to get a full knowledge of any important trade or handicraft. No youth can possibly learn the multifarious intricacies of the ironmongery trade in three years—indeed, there are many, unfortunately, who come to the end of the full seven years without having a more than sadly imperfect knowledge of the trade. This may be the case for a variety of reasons, we are aware, and it is alleged that where there is an unusual amount of density on the part of the youth the fault is not always his own. Even in such cases, however, the fault pertains to some individual rather than to the system. In all systems there are faults and shortcomings. Apprenticeship may be specially liable to them, but even if that is the case it must be upheld unless and until some better plan is forthcoming for the practical education of young tradesmen or craftsmen. Such a plan is not yet forthcoming, and we do not expect to hear of it yet a while.

"POWER" IS POWERLESS.

A New York coverless monthly called "Power' (or, as the name appears on the front page, "Power *Steam*") shows a considerable degree of uneasiness. They have tried hard to get a footing in the N. A. S. E., but the *Weekly Stationary Engineer* keeps *Power* out. "Mechanical Editor" F. R. Low did his little utmost to publish a daily issue during the recent N. A. S. E. convention at Omaha, but the *Daily Stationary Engineer* (as the unofficial organ of the N. A. S. E.) again put *Power* in the shade. Miserable *Power*!

The Nationalists have expressed displeasure at their unofficial organ several times, but to try to go between the N. A. S. E. and the *Stationary Engineer* is as foolish as interfering between man and wife when a little disagreeable. *Power* has found this out, by bitter experience.

In its issue for October, *Power* has ventured to introduce a new tune; they now seek to charm the N. A. S. E. by daubing Past-President Illingworth with very coarse taffy. And as an accompaniment to their "He's a jolly good fellow," they make a false accusation against the AMERICAN ENGINEER: they say that we take "a specially objectionable form in the attempt to belittle Past-President Illingworth." *Power's* estimate of Bro. Illingworth is too mechanical altogether. According to what we published concerning him and the "Omaha Convention," Mr. Illingworth has a great merit that Mr. Low does not perceive, it seems. We merely quoted from the Omaha papers and the *Daily Stationary Engineer*, from which it was evident—

(1.) That J. J. Illingworth was not the right man to be president of the N. A. S. E.

(2.) That Mr. Illingworth was himself aware of that fact, which is a very important point in his favor.

Any fool may be man enough to accept a presidency that is offered him, but it requires a wise man to know when he is unable to perform the duties of such a position properly. And when a man knows what he cannot do, he is a very superior being to the creature that simply knows (or imagines) what he can do. Herein Mr. Illingworth is far ahead of Mr. Low, and evidently the "mechanical editor" of *Power* has yet to learn what he cannot do.

Power has always been antagonistic to the A. O. of S. E., especially since the Order passed over it and selected the AMERICAN ENGINEER as its organ. They have still a forlorn hope that the N. A. S. E. may perchance give *Power* a show, in preference to their own dear unofficial organ. But as for the American Order, their last hope in that direction has vanished with the recent change in the management of the Order's own paper. Power is nobody's paper, and "sings a song for sixpence" for anybody that comes along.

THE TIN INDUSTRY.

We have no place for politics in our columns. Our constituents are divided between the Republicans and Democrats, and perhaps a few of them are Prohibitionists. And our position is impartial, or rather entirely outside of the political arena. From this standpoint, the tin industry is a delicate subject to discuss. In fact there are two sides to the question. And the political campaign, especially in Ohio, hangs between tin and no tin. Major McKinley's followers adorn themselves with tin as passionately as the red Indians put on their war paint, and they declare that tin is being manufactured, and going to be manufactured on a very extensive scale in the United States, while the Democrats declare that no tin is being made nor going to be made in this country. In order to keep out of politics, perhaps we ought not to express an opinion as to which party is right—until the coming elections are over. By that time, tin works that are now being erected will be finished, and in working order probably. In the mean time, it may not be out of place to note what business men say about the tariff as far as it effects the manufacture of tinware, and as to the state of business in the tin trade. In another column we give the views of the tinware manufacturers of Maryland, who seem to be delighted with the tariff, as far as it affects their business.

It is interesting to note what is the condition of

the tin market across the water. *The Ironmonger*, (London) of September 26, says:

Tin.—This metal has been flat, but the fluctuations have been confined to very narrow limits. At the first 'Change on Friday of last week a small business was done in cash at 91*l.* 10*s.*, three months being 91*l.* 17*s.* 6*d.* to 92*l.* In the afternoon the market was quiet, with only a little business reported. The total transactions for the day amounted to 30 tons. Monday's opening 'Change showed a very dull tone, with little or no disposition to operate. Cash metal was quoted 91*l.* 7*s.* 6*d.* to 91*l.* 10*s.*, and three months 7*s.* 6*d.* premium. In the afternoon the market was again quiet, closing prices ruling as in the morning. About 30 tons represented the day's transactions. On Tuesday morning a small business took place at 91*l.* 5*s.* cash, and 91*l.* 15*s.* for three months. Afternoon's values were steady, but business was once more quiet, no transactions being recorded. About 40 tons were the day's transactions. On Wednesday both 'Changes were devoid of business, cash being nominally quoted all day at 91*l.* 7*s.* 6*d.*, and three months at 10*s.* premium.

Tinplates.—*London.*—A very quiet market rules just at present. A fair number of inquiries on forward account have been placed before makers, but there is not much disposition to quote, as it is believed that many of the inquiries are mere feelers. *Liverpool.*—This market has been dull during the week, for, although there is a fair inquiry for forward delivery, not much business has been done, owing to the disparity in buyers' and sellers' ideas of price, the former expecting to place their orders at less than present price for prompt delivery, and the latter being firm at to-day's price in the face of short supply of tinplate bars and a probable demand from the United States for large quantities of tinplates very shortly. The shipments to San Francisco during the past few weeks show the reports of heavy stocks held there when the new tariff came into force to have been false.

THE CREDIT DUE TO ROBERT FULTON.

It is in the making of the steamboat idea a commercial success that the famous Robert Fulton is to be rightly honored. He did for steam navigation what Edison has done for electric lighting—making it a success on a commercial basis. Fulton was not the original inventor of the steamboat, but he was the first to make it pay.

A paper called the *Western British American* recently announced that Fulton was not the original inventor of the steamboat navigation, and that he got his ideas from a Scotchman. That paper says that in 1801 Fulton got from William Symington, a native of Lanarkshire, Scotland, the original ideas which he put into operation on the Hudson some six years later, when he made a trip of 110 miles in the Clermont in twenty-four hours. It says that as early as 1788 Symington attained a speed of four miles an hour with a little boat on Delawinton Loch, and in 1801 made a successful trip to Glasgow in a vessel named Charlotte Dundas, which towed up the River Carron four or five sloops that had been detained in the Forth by contrary winds. Fulton, it says, was a passenger on that vessel and took copious notes.

Other papers have "discussed" the subject, one of them being the Chicago *Tribune*, which puts the whole matter in a nutshell, as follows:

If the question involved be one of priority of invention the credit does not belong to Symington but to John Fitch, a native of Windsor, Conn., who, the 15th of April, 1785, conceived the idea of steam as a motive power to propel wagons and vessels. Later in that year he completed his first model of a steamboat with wheels at the sides; but as these were found to labor too much in the water he replaced them in July, 1786, with paddles (upon a skiff which had a steam engine with a three-inch cylinder.) After vainly trying to obtain aid from Congress and the Pennsylvania Legislature, and acquiring the reputation of being insane, he began in February, 1787, the construction of his second boat, 45 feet long and with 12 feet beam, which "made its trial trip on the Delaware at Philadelphia the 22d of August, 1787," in the presence of the members of the convention to frame the Federal Constitution. A still larger boat was constructed in 1788, and another in April, 1790, the latter being run during the whole summer as a regular passenger boat between Philadelphia and Burlington with a speed of eight miles an hour. Another boat, the Perseverance, designed for both freight and passengers, on the Mississippi, was damaged by a storm and the project was abandoned. In 1791 he received a patent from the United States for his inventions, and two years later went to France to build a steamboat, but arriving their in the midst of the revolutionary troubles he left his plans and specifications with the American Consul, who subsequently loaned them to Robert Fulton while Fitch was absent in London.

We must accord to John Fitch of Connecticut the credit for priority of invention of the steamboat, as he thought out the scheme two or three years ahead of Symington of Scotland. But, after all, it must be conceded that the first practical *commercial success* in steam navigation was achieved by Robert Fulton. Fitch was some twenty years ahead of him, but for some inscrutable reason the people of the United States did not recognize the usefulness or possibilities of his great idea, not to say the necessity of the invention, though water transportation was the bond absolutely needed to tie together the States, both by seaboard and interior communication. The people did not believe in Fitch's scheme—regarded it as chimerical or at least impracticable—and even so eminent an engineer as Latrobe said the scheme would not amount to anything and must end in financial failure. But when Fulton came along later and pushed the matter energetically, and built a steamboat that did a paying business, steam navigation was admitted to be a good thing, and almost from the moment the demonstration had been forced upon their attention they took hold of it with customary Yankee vigor and thoroughness, accepting it rather as an essential than as a luxury. In a very short time the steamer was a prominent object on all our inland waters as well as on the ocean coast, and did very much to aid the opening up of the Missippi Valley to settlement. For this practical and profitable application of steam navigation to commercial uses and interior development Robert Fulton is entitled to the credit, while to John Fitch belongs the honor of having first pointed out the path for Fulton to travel; and it does not appear that Symington deserves to rank in history with either of these illustrious men.

WINNERS OF THE WIDOWS' VOLUMES.

The marked page in one of the volumes offered some time since was No. 343. John Miller, Superior street, Cleveland, O., and Walter J. Mills, 707 Carbon street, Syracuse, N. Y., both hit upon this page, John Miller being the first, and he therefore had the choice.

JEFFERSON YOUNG, JR., PHOTOS.

We have on hand a few more of Bro. Young's photos to be sold for the Harry Hohn Fund. We urge the members of the A. O. of S. E. to help in every movement that will aid this unfortunate brothers to procure his artificial limbs.

Large size photos for lodge room, $3.00, cabinets, 50 cents. Send postal note or stamps. American Engineer Pub. Co., Pontaic Building, Chicago.

THEY DISCOVERED THE CAUSE.

This is the way a Chicago daily paper explains how the cause of a boiler explosion was discovered:

When the tug C. W. Parker was taken into dry dock it was found that the lever of the engine was reversed. This accounts for the explosion. Foaming water rises in a boiler when steam is being drawn off, and falls to its natural line when the engine stops. The water in the Parker's boiler was low, and when the engine stopped it uncovered the crown-sheet. Then, as the engine started again, it rose, struck the highly heated surface, and was at once turned into steam, thus causing the explosion.

Charles Garrett, of Hot Springs, Ark., will exhibit at the World's Fair his extensive collection of mineralogical specimens, including the famous Hot Springs diamonds.

STEAM BOILERS FOR ELECTRICAL INSTALLATION.

By W. H. Booth and Frank B. Lea.*

Continued from Page 147.

The mass of water is small, and as steam rises up the narrow water space it carries with it very much water direct to the steam pipe. This action is intensified, first, by reason of the very limited distance from the water surface to the steam pipe; secondly, by the very limited area of the water surface from which steam has to escape; and thirdly, by the small volume of the steam space which must vary in its pressure with every stroke of the engine, and cause irregular outbursts of steam. Hence the advantage of high-speed engines for boilers of insufficient capacity. It is, however, seldom the case that vertical boilers are at present used for anything but small installations of a portable character. With water tube boilers of the type now usually constructed with sloping pipes, there appears no reason to doubt the fair circulation of their contained water, nor the dryness of the steam they produce when the steam-drum is not too full of water. The water tube boiler has, however, the serious disadvantage of being a smoke-producer. Its considerable employment in the United States may be traced to the fact that it has been used so much with smokeless anthracite.

With bituminous coals, however, it tends to be a smoky boiler.

The reason for this is simply that the products of combustion and gas distillation rise straight from the surface of the grate, where they are produced, directly amongst the water tubes above where they are cooled down before combustion could be completed, even if the conditions for perfect combustion were present. They are not present. The perfect combustion of bituminous coal requires four main conditions, viz.:—

1. The admission of fresh air above the fire surface over and beyond that which passes through the fire by the grate.

2. The thorough mixture of this fresh air with the evolved hydrogen gases of the coal.

3. A temperature usually understood not to fall below a minimum of 1,000° Fahr.

4. A certain free unimpeded space in which combustion may complete itself after ignition.

To give point to the foregoing, we will show how these four conditions are fulfilled in the Lancashire type of boiler. The fire is usually of considerable length. In the furnace door the admission of fresh air is provided for by an air grid giving something like 1½ square inches of opening per square foot of grate surface. In traveling over the fire such air is mixed with the gases evolved, and by the time the bridge is reached the mixture will be heated to the point of combustion. This takes place at the contraction of the bridge opening, and completes itself in the iron flue beyond. Practical combustion is but little understood, even by those who should make it a subject of study. The combustion of impure coal gas, diluted as it is with carbon dioxide from the solid carbon burned *in situ* by the air which passes through the grate, is more or less uncertain. It approaches more or less closely to the state of a flickering flame, such as that seen above any newly-coaled house fire. Very little serves to put out the flame, and we have known a case where two boilers, in every known respect exactly similar (with the exception that in one of them there was an extra water tube close up to the bridge), were yet entirely different in behaviour. The extra water tube caused the one boiler to be smoky, whereas the other was free from smoke, and yet the smoky boiler was cured by bringing its bridge some 3 inches clear of the extra water tube, the shock of meeting which by the newly-ignited gas put the flame out.

When the draught is sufficient to draw in the necessary fresh supply of air at the doors, the Lancashire boiler may be made smokeless, but it should contain no water tubes near the bridges. It may, indeed, be a matter of wisdom to entirely discard cross tubes in the flues of any Lancashire boiler. Of course this is contrary to general practice, but it has never been conclusively shown that such tubes are a source of either strength or economy,

*In the *Electrical Review* (London.)

while there have been experiments showing to their disadvantage, and they are decided obstructions to draught, to cleaning, to inspection and repairs, and a source of increased first cost as well as a complication added to a boiler, the special feature of which is simplicity and accessibility.

This boiler is essentially a boiler for permanent work, and deserves more consideration than has yet been accorded it by electrical engineers, who have, so far, adhered to boilers of a more or less portable type.

As we have already in a recent article under the head of "Rope Driving" fallen back for illustration upon the steam engineering of cotton mills, we may do so again, and enquire the reasons for the continuous success of the Lancashire boiler.

The arguments against it are:—

It is costly; it is large and clumsy; it requires a heavy outlay in brickwork for seatings.

On the other side we may say:—

Though costly it is durable.

Though large, it is not specially so for its output of steam.

Though costly to set, it gives economical results.

Further, as stated, it may be made smokeless.

The special points which have made it a favorite with the cotton spinners, who want steady turning, are its large steam space and its large water contents. When at work, and heated throughout, it has an enormous store of heat. A sudden demand for more steam is readily responded to, for a small fall in pressure sets free a large amount of heat from the mass of water, and conversely on a stoppage of demand for steam the water will absorb the heat of the furnaces, and pressure will only slightly increase.

The boiler is, in fact, an accumulator or heat reservoir, and it is practically universal as the steam producer for motive power in the textile districts of Lancashire, Yorkshire, Cheshire and Derbyshire.

The demands of the textile factories closely resemble those of an electric installation, and it would appear reasonable to conclude that for first-class installations of an extensive character involving several hundred indicated horse-power, steam boilers of the above type will give the best results in working and in fuel economy, allowing, as they do, of the use of any description of fuel which may be cheapest.

Feed water heaters ought to be worked in conjunction, though the heat rejected by the Lancashire boiler is not so great as that rejected by other boilers which have no external brickwork flues. The feed heater of the vertical water pipe variety has so far been a favorite to accompany Lancashire boilers.

For usual conditions, probably the best dimensions will be:—Boilers of 7½ or 8 feet internal diameter and of a length of about four diameters.

The advantage of the larger boiler is the better combustion in its larger furnaces.

The furnaces of a 7 feet 6 inches boiler will be 36 inches diameter; those of an 8 feet boiler 39 inches or 40 inches diameter. When hand fired, a firegrate length of 6 feet is usually as much as an ordinary fireman can keep properly covered and attended to.

This gives a grate area of 36 square feet in a 7½ feet boiler, or 40 feet for the 8 feet size.

The consumption of coal will range from 15 to 25 lbs. per square foot per hour.

About 21 lbs. is a good, comfortable rate, for constant work, which implies 840 lbs. of coal per hour in the 8 feet boiler, and an indicated horse-power varying, of course, with the class of engine. Taking the usual style of compound engine employed in the North, a horse-power requires about 1¾ lbs. of coal per hour, and on this basis an 8 feet boiler will serve for 480 I.H.P. with fair coal and condensing engines.

The example set at Deptford station of placing their motive power near an unlimited supply of condensing water will surely find imitators, and there can be little doubt that steam power on a large scale will be found too expensive to produce within City limits. The placing of boilers in cellars and the attendance of machinery in dens of discomfort connot be fraught with economy or long carried on atisfactorily.

In preferring what some style the old-fashioned Lancashire boiler to the newer productions of the water-tube boiler makers, we may be charged with mechanical Conservatism, and yet we do so fully confident that the boiler which will best survive is the so-called older type. Water-tube boilers, we are told, are extensively used in the United States. As we have already stated, the conditions there are different, the coal suited to such boilers is found there abundantly, and used almost to conclusion in New York and some other cities.

At the same time, the boiler which is *par excellence* the American boiler is not the water-tube boiler, but the under-fired cylindrical boiler with return tubes of 3 or 4 inches diameter. These boilers, the usual length of which is, perhaps, 12 feet, and the diameter 5 feet to 6 feet, are turned out by American boiler works at a remarkably rapid rate. For efficiency and small first cost they are, perhaps, the cheapest boiler made, and for bituminous coals their wide under-furnace with brick sides gives them a good chance when properly set of being worked without smoke. English boiler insurance companies do not like boilers of this type; they object to under-firing of a shell exposed to pressure, and yet one is tempted strongly to question the legitimacy of this objection in face of the fact that such boilers are worked in America at pressures which are for single riveted boilers higher than those allowed for double-riveted boilers in England, whilst for a certain section of the country and certain boilers, the working pressure exceeds English test-pressures.

A fact which goes a long way to place American boiler-making, in spite of much crudeness, on a good basis, is the law which fixes the working pressure from the ultimate tenacity of the plates and their ductility.

These American under-fired boilers, it should be noted are very short.

This fact must surely—or ought surely to—tell in their favor as compared with the customary length of English under-fired boilers.

Granted that under-firing distresses a boiler, the distress must be least in a short boiler, the under seams of which are not so liable to be strained by the movement of a long unsupported length. This may easily happen with a 30 feet long boiler, should the setting give way even an eighth or a quarter of an inch over a portion only of its length.

These short under-fired boilers are, at least, always of fairly uniform temperature throughout, and on the score of cost, efficiency and cheapness, are on a better footing than water-tube boilers, whilst, as regards steam space, water volume, and steadiness of working, it is doubtful if they are any way behind the Lanchashire boiler, and we do not see why this simple American boiler could not be largely used with safety, especially at English pressures, or why the external firing of a boiler need take the hair off any chief engineer of a boiler insurance company, especially if the water is pure, or of such nature as to be amenable to some of the many forms of mechanical sediment removers known to be good and serviceable. While, therefore, the Lancashire boiler appears to stand pre-eminent as the steam producer for very large installations of electric machinery, the simple under-fired return tube boiler, set in brickwork, follows very closely for smaller permanent work. When employed, it should have a combustion chamber of considerable size at the back end for the gases to become thoroughly burned previous to traversing the return tubes, and also a clear and distinct vertical water space up the middle of the tubes, which should thus be arranged in two wings, so to speak. This will facilitate circulation, and promote steam dryness, which is so important a factor in economy.

A Turkish flag was hoisted at the World's Fair grounds on Sept. 20 with appropriate ceremonies. It was raised on the site which Robert Levy, of Constantinople, has secured for his Turkish specialties. He will reproduce a Constantinople street, show most of the striking features of Turkish life and have a novel and interesting collection of Turkish goods and curios. The flag was raised in conjunction with the stars and stripes and is the first one of the scores of foreign flags eventually to enliven Exposition scenes.

MARYLAND MANUFACTURERS OF TINWARE.

A communication from Baltimore, Oct. 9, says:

Congressman Bunting of the Thirty-third New York District, and representing the American Tinplate Consumers' Association, had a conference here this evening with twenty-five prominent manufacturers of tinware. All the prominent manufacturers of tin cans, one of Maryland's largest industries, were present. Mr. Bunting asked the Baltimore manufacturers to subscribe to the Tinplate Consumers' Association, which purposes to investigate the effect of the new law. Every one of the manufacturers present, while willing to subscribe to the appropriation, expressed his satisfaction with the present tariff on tin and opposed any change whatever in the law. Mr. Matthai of the firm of Matthai, Ingram & Co., the largest tin can manufacturers in the country, said that he was confident that tinplate would soon be extensively manufactured in this country, and equally as good if not better in quality than the imported plate. The Baltimore manufacturers would only agree to become subscribers to the association upon the guarantee of Mr. Bunting that the association was not intended to in any manner injure or disparage the manufacture of tinplate in this country.

WIRE.*

As metal working in some form is a branch of nearly every iron-monger's business, he has, probably, and certainly ought to have, a closer knowledge of the process by which the goods he sells are manufactured than is usual elsewhere in the retail trades. The ordinary grocer knows little of, and very likely cares less for, the processes of extracting and refining sugar, just as the average stationer takes little thought of the working of a paper mill or the ingenious mechanism that cuts, gums and folds the envelope he sells. But the ironmonger is supposed to be something of a smith at least, and the possession of a handicraft must open the mind to an appreciation of mechanical and manual processes that is almost intuitive, and must breed a genuine curiosity to explore further into processes which are an amplification of his personal training. To all such a recently published and fairly comprehensive work* on the history of wire manufacture and its many uses will be most interesting. Mr. Bucknall Smith, the author, is an expert in his subject, and has brought together a vast amount of information upon every branch of it. The topic has nowhere else been treated with any approach to the completeness of this volume. Indeed, its comparative neglect hitherto is surprising, when we consider how largely wire, of various metals, and in one form or another, enters into the necessities and luxuries of life. Mr. Bucknall Smith has, therefore, performed a very important service, and performed it well. He has traced the history of wire-making from the earlies times; explained the various processes in vogue, and their development; illustrated and described the most improved modern machinery; and given at some length the rise and progress of the industry in England, by reference to the great manufacturing firms that have been and are associated with it. He has furnished much curious information, showing the extraordinary delicacy of wire-drawing in some branches of the art, and has treated of all metals, gold, silver, copper, platinum, iron, steel, etc., which lend themselves to wire-drawing. He has a most useful chapter on gauges, of greatest interest and value to everyone who is connected with the manufacture, sale, or use of wire and wire goods. In the second section of the work, especially those chapters which treat of wire ropes, the author is in his special field, and this branch of the topic is treated with great fullness and wealth of information. The remainder of the book deals with other manufactures and uses of wire, such as netting and woven fabrics, fencing materials, nails, garden structures, etc. There are few pages in the work which the intelligent ironmonger would fail to read with interest and not find useful as well, and the numerous tables scattered throughout the volume will always be valuable for reference. An exceptionally full and well-prepared index accompanies the book.—*Ironmongery.*

* A Treatise upon Wire; its Manufacture and Uses, embracing comprehensive descriptions of the constructions and applications of wire ropes. By J. Bucknall Smith, C. E. With 159 illustrations and numerous tables. London; Office of "Engineering." 7s. 6d.

CORRESPONDENCE.

Thanks.

Editor, American Engineer:

W. E. Crane Council has been the recipient of a valuable book entitled "Steam," published by the Babcock & Wilcox Co., of Boston, Mass., and they would like to publish a vote of thanks through the columns of The American Engineer.

Please change the address in the directory of your paper, of S. W. Wood from 298 South Main s'reet, to 986 South Main street, and council meets every Saturday night at eight o'clock at Doherty's Block, East Main street. Yours fraternally,

S. W. Wood, Recording Engineer.

Albany Council No. 11, N. Y.

Editor, American Engineer:

The following have been expelled from Albany Council No. 11, N. Y., for non-payment of dues:—

James Wilson, William Mahar, James Dennia, Alfred Hymas, Lewis More, John Ahren, George Campble, George S. Farrell, F. M. Roach, Charles Van Burin, Frank Early.

Yours fraternally,

Edw. Mull, Cor. Eng'r.

What is the Trouble?

Editor, American Engineer: — Corliss and Old Slide Valve, and others, have been talking a great deal of late. I have a nut for some one to crack: Here are cards taken from a 10x14 Buckeye engine, and as far as the eye can see the valves are set correct. I state this as many would think that the cause is here. This engine has given me a great deal of trouble; it is placed on a foundation 6′ deep and still shakes and takes steam from a boiler 48″x 22′, 12′x6″ flues; the fireman is kept busy shoveling coal and drawing ashes, and still cannot keep up steam. J. W.

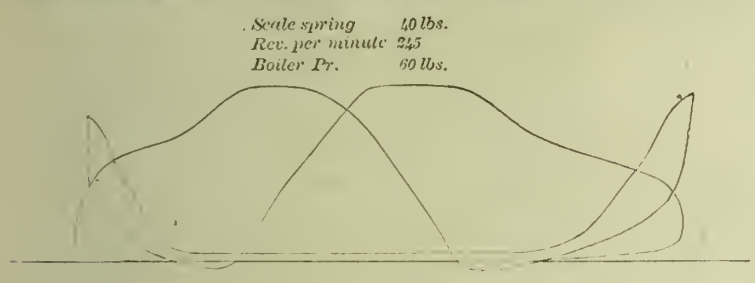


Fig. 1.

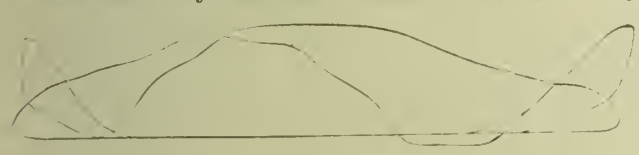


Fig. 2.

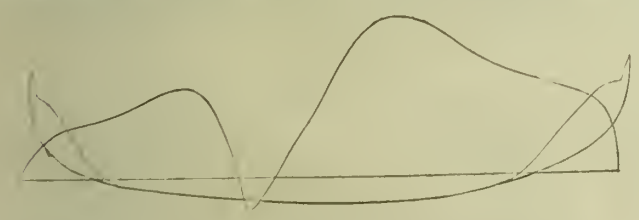


Fig. 3.

A Voice from Buffalo.

Editor, American Engineer:

I have not seen anything in your paper from Buffalo for a long time. I thought I would write you a short letter and tell the boys how the A. O. of S. E. is progressing here. Jefferson Young, Jr., Council No. 14, is doing splendidly. We are taking in new members about every meeting, and now that we are done with the bad weather, I expect the boys to buckle down to business and improve themselves in their chosen profession. The insurance feature of our Order is working a great many engineers up to a high pitch, and they are going to make the A. O. of S. E. still greater in good work as well as in numbers. I find a great many engineers, who ignore theory in steam engineering and seem to think that book-learning is no good; but they will wake up some fine morning and find themselves at the tail end of the profession, and trying to find out how to get a license. Our license law takes effect Jan. 1st, and all good engineers are in hopes that it will be a success, as we will be working under a reformed city charter.

Saturday evening, Oct. 10th, we instituted Queen City Council No. 15, in this city with thirty-three charter members. They will be located in the center of the city, and if we can judge by appearances, No. 15 will be heard from in no uncertain tone, before the meeting of the Grand Council in '92. We expect a visit from Grand Chief Engineer, Bro. Teller next week. He expects to make all the boys a short visit in their engine room; if he does, he will have to stay more than his intended one week.

I was much pleased with the letters in the American Engineer from "Corliss" and "Old Slide Valve." Sometimes they make you laugh; at others they set you to thinking, and it is my opinion that they have set a great many of your readers to thinking. There is lots of fun and some very good arguments made by both your correspondents. They do no harm and are liable to do some good. Let us hope they will. Hoping that this will get past the office cat, and that you are all well and happy, I remain, Yours fraternally,

B. P. K.

COLORADO.

The good news that Brother Jno. R. Price, Deputy Supreme Chief Engineer of the State of Colorado, has succeeded in organizing the first Council of the A. O. of S. E. in that state, came on Oct. 10th. The new Council is named Silver State, No. 1, and the petition shows 25 charter members, the majority of whom have seen long years of experience as engineers.

We publish the list with pleasure.

W. A. Morris	N. M. Mack
Jno. Price	Wm. Lockwood
Ed. Mungler	Henry Bond
Jno. J. Ray	Chas. Anderson
Jno. Race	Jamer H. Dean
W. W. Chalfant	W. M. Watson
A. S. Tyler	F. D. Spur
J. M. Smales	J. F. Wood
E. H. Walker	Wm. A. Tyler
T. E. Oban	Geo. Polkinhorn
Geo. Rork	Chas. Bond
A. W. Simons	L. W. Parkhurst

A. B. Hensley.

We congratulate Brother Price upon the splendid start which they have made. From the ages of the men and their long terms of experience, we have no doubt that the Council is composed of men of the right stamp. We wish them every success and hope that this Council may be the means of spreading the work of the Order throughout the State of Colorado. A list of the officers will appear in next week's issue. We hope to hear from the members of Silver State Council often and are pleased to inform them that the columns of The American Engineer are at their disposal.

COUNCIL BLUFFS COUNCIL, NO. 2, IOWA.

The following is a list of officers sent in by the above Council:

Past Chief	H. P. Mudge
Jr. Ex-Chief	Ralph Simson
Chief Engineer	W. H. Rufcorn
First Assistant Engineer	E. W. Kramer
Senior Master Mechanic	Z. T. Jones
Jr. Master Mechanic	Wm. Burke
Rec. and Cor. Engineer	F. A. Chapman (629 9th Ave.)
Finan. and Treas. Eng.	T. J. Crothers
Chaplain	D. W. McCreary
Inside Sentinel	Louis Poterson
Outside Sentinel	Robert Oleson

The Association of Civil Engineers of the City of Mexico has voted unanimously to attend the Columbian Exposition in a body.

A. O. S. E. MEDICAL CERTIFICATES.

Orders for medical blanks come in slowly, also list of members of the various councils of the A. O. of S. E.

Just received a list of medical certificates from Onward Council, No. 4, all filled out, accompanied with a check for a goodly amount to cover their first assessment. This council means business, for they have forestalled my call for an assessment and stand first in the "good work," which shows their confidence in themselves, rather than wait to find what confidence they can find in others, and recognizing the oath of fellowship in one common purpose. Chas. E. Jacks, Sec. & Treas. B. F.

THE HARRY E. HOHN FUND.

We have received substantial proof this week that our brothers of the Order have not forgotten the Harry Hohn Fund. Franklin R. Moore, treasurer of the fund, reports that Andrew J. Williams Council, No. 3, Danbury, Conn., has generously donated the sum of $18 for Brother Hohn's benefit. We publish this report with pleasure, and we hope that the members of the American Order of Steam Engineers will not forget this young brother, who has been so terribly injured. He is now trying to purchase a pair of artificial legs, and as they cost in the neighborhood of $200, he will need several more contributions.

Boys, be generous.

AN EXTRAORDINARY EXPLOSION.

The following appears in the *Ironmonger*, (London):

An accident of an extraordinary nature occurred on September 18, in the moulding shop of the Crewe Steelworks. A laborer named Whittle, and a boy sixteen years of age named Owen, were carrying between them a snag full of molten metal. For some reason or other they found it necessary to lay the slag down. The bottom of the ladle being round, it would naturally tilt over if laid upon the flat ground. A metal pot partly filled with water, in which was kept the snag rags for wetting the edges of the moulds, was thought convenient by the two men to lay the snag across. No sooner had it been put down than a terrible explosion occurred. The fluid metal was scattered in all directions, fearfully burning Whittle about the body and arms, and the lad Owen about the legs and lower parts of the body. A moulder named Hughes was standing near. A splinter of the metal-pot tore his right ear clean off, besides lacerating the whole side of his face.

BALL ENGINE AT THE WORLD'S FAIR.

The following communication speaks for itself:

WORLD'S COLUMBIAN EXPOSITION.
D. H. Burnham, Chief of Construction.
D. L. Olmsted & Co., Landscape Architects.

Ball Engine Company, Erie, Pa.:

Gentlemen:—We started last night the 10x12 engine kindly loaned by you to us for our temporary power and lighting plant. I have to congratulate you herewith upon the start made, which I have no hesitancy in saying was the prettiest I have known in my experience.

We started the engine under full load at six o'clock, and it ran until six o'clock this morning without the slightest trouble from heating or any other cause. I consider it a very valuable record.

Please accept my thanks for the promptness with which you filled our order, and for your liberality in furnishing us this engine.

Very respectfully yours,

(Signed) J C. Slocum,
Mechanical Engineer.

WILL BUILD A STEEL BOAT.

The Excelsior Marine Benevolent Association, composed only of captains, will build a first-class steel freight boat during the winter on the co-operative plan. It will cost $200,000 and members will take all the stock. In order to prevent capitalists getting control of the steamer no member can hold over $5,000 of the stock. The scheme is a new one, but the officers of the association say they have no doubt of its success.

THE WOMEN'S DEPARTMENT.

AMERICAN GIRLS.

"The fact that American girls go anywhere and almost everywhere without escorts has long been a matter of wonderment to me," said a member of the French nobility to me the other day. "I was coming down in an elevated train yesterday, and the reason was made evident to me. As we neared the City Hall station almost every passenger made a rush for the door and stood for five minutes, each anxious to get ahead of the other in leaving the train.

"One of the crowd was a very pretty young woman carrying a long-handled umbrella in one hand and a big bundle in the other. Just behind her was a short, very fat man, who was rudely crowding the pretty girl. As I had not left my seat I saw the performance that followed.

"Once the girl looked over her shoulder and the fat man stopped crowding for a moment, but began again and trod on the skirt of the pretty girl. Her eyes grew dark with anger. The long-handled umbrella assumed a horizontal position and shot backward, point first, catching the fat man just about at the bottom of his vest. He gave a gasp of terror and caught his breath just as the pretty girl looked over her shoulder, smiled sweetly and said: 'Oh, pardon me; but you are on my skirt.'

"Then she smiled even more sweetly, and the fat man dropped into a seat and groped about as though the air in the car was suffocating him. The girl marched complacently out of the car, head up, the dainty feathers in her hat nodding defiance to all masculine humanity."—*New York Telegram.*

A FEMALE LOCOMOTIVE ENGINEER.

Ida Hewitt is a young woman who runs a locomotive on the Cairo short-line in West Virginia, which is a narrow-gauge connection of the Baltimore and Ohio, says the Chicago *Tribune*. She is 24 years old, and is said to be very prepossessing in appearance. Miss Hewitt is the daughter of one of the chief owners of the Cairo short-line. The machine shop of the road stands near Mr. Hewitt's house, and Ida when a child played around the shop and learned about the mechanism of locomotives. It became a passion with her to ride on them. She even learned the use of the tools that are used on a locomotive. A few months ago the single engineer of the road fell ill and Ida volunteered to do his work at the lever. The man died and Miss Hewitt, having run the engine up and down the line to everybody's satisfaction, was made the regular engineer. She is a blonde, and wears a cap over her hair, a suit of blue cotton goods, heavy shoes, and gloves. Her locomotive is much neater than when a man was the engineer and she has been behind time only once. Mrs. W. Newton Lynch, West Virginia's representative on the Board of Lady Managers at the World's Fair, discovered this fair phenomenon. Miss Hewitt will be invited to take a train loaded with West Virginia's mine and forest products to Chicago.

PRICES OF WIVES IN INDIA.

The British acquisition of the Punjab is said to have raised the price of wives to the average Brahmin and Rajpoot farmer. At the time of the annexation a wife could be purchased for from 20 to 40 rupees; the quotations vary at present from 60 to 300 rupees. The decrease of infanticide in the Punjab is said, indeed, to be largely due to this enhancement in the prospective value of female infants. The custom of selling girls is meanwhile becoming increasingly common, and instances are reported in which the very hightest class of Rajpoots have purchased their wives in this way.

The Cincinnati Technical school permits girls to take all its courses, even to the engineering and carpenter work. This summer two Kentucky girls, Lucy Mary Riggs and Julia Bedinger, received diplomas. They not only learned architectural and mechanical drawing, but became expert in the use of carpenters' tools, and are practically familiar with the use of steam machinery.

WHAT WOMEN HAVE INVENTED.

A California woman has invented a baby carriage which netted her over £10,000, while to Mrs. Catherine Greene, the wife and widow of Washington's ablest officer, is due some of the honor of inventing the cotton gin, one of those distincly American inventions the value and importance of which have been recognized by the whole industrial world. A horseshoe machine which turns out completed shoes was the invention of a woman; also the reaper and mower, the idea of Mrs. A. Manning of New Jersey. Mrs. Manning seems to have stimulated the inventive genius of her neighbors, for a few years after her reaper and mower was patented Mrs. Elizabeth Smith of the same State took out a patent for an improvement on this machine, being a device for changing the knives without stopping the wheels. One of most complicated machines ever made is that for the manufacture of re-enforced bottom paper bags. It was the invention of Miss Maggie Knight, who, from it and other inventions in the same line, realized a large fortune. A street sweeper of great merit was devised and patented by a New York woman who had a costly dress ruined by the mud splashed on it from a defective machine. Most remarkable of all is the invention of Mrs. Mary B. Walton for deadening the sound of car wheels. She lived near the elevated railroad in New York, and was greatly annoyed by the sound of the roaring trains passing her house. The most noted machinists and inventors of the country had given their attention to the subject without being able to furnish the solution. A woman's brain did the work, and her appliance, proving perfectly successful, was adopted by the elevated roads, and she is now reaping the rewards of a happy thought.

EDUCATING OUR DAUGHTERS.

How to educate our daughters is a problem with which we have always to battle, says the Detroit *Free Press*. To establish an economical fashion is well, only let it be one of prevention in preference to one of cure. To rear a girl in absolute dependence, good for nothing, selfish in her aims and exacting in her demands, is a sin against the daughter and against society. To begin at her birth to economize and retrench in every department for the accumulation of money, that this monstrous perversion of her life may be accomplished and maintained, is grotesque and heathenish.

Girls thus trained will fail of attaining a high order of womanhood. Their aim will be petty, their ideals low, and nothing very excellent can be expected of them in wifehood or motherhood. While we carefully guard whatever is womanly in our daughters, let them be trained to more of fiber and firmness. Educate them to self-denial, if pecuniary circumstances demand it, and not to self-indulgence. Accustom them to be of service in the household, to regard economy as praiseworthy and even heroic, and to add to all their other accomplishments a practical knowledge of work and the possession of some industry by which they can support themselves. Such girls when portionless, will carry to their husbands dowries in themselves.

MISS BEATRICE POTTER.

Miss Beatrice Potter, who is the eighth and only unmarried daughter of Richard Potter, of Standish, Gloucestershire, England, is a young woman whose name is familiar to all persons interested in what has been termed the "dismal science." Miss Potter is also interested in questions of social reform, such as co-operation, the sweating system, the housing of the poor, etc. Her father, who was once a great magnate in the railroad and financial world, is now an invalid, and her mother is a daughter of A. Haworth, M. P. From the years 1886 to 1889 Miss Potter was engaged in assisting Charles Booth in the preparation of the first volume of his great work on the "Life and Labor of the People," to which she contributed a chapter on the Jewish community of east London, in addition to articles on the docks and the tailoring trade. In order to obtain absolutely correct information on the latter subject Miss Potter spent six weeks under a master tailor training as a tailor's finisher. She then disguised herself as a "tailor's hand" and boldly sought employment in the East End. The poor, untidy dress and bonnet, rough hair twisted into a knot and appearance of extreme poverty which she assumed gained her admittance only into the lowest "sweater's dens," where the work was exceedingly coarse and heavy. Six weeks' training had not hardened her fingers sufficiently to make twelve or fourteen hours continuous sewing on shoddy clothes an easy matter, so her work was sufficiently bad to insure her tolerably frequent dismissals and thus to widen the field of her investigation. Having thus acquired a practical acquaintance with the problems to be dealt with by the select committee of the house of lords on the sweating system, which commenced its inquiry in 1888, Miss Potter was naturally one of the principal witnesses, and several of her recommendations were embodied in the report of that committee. She is an honored guest at the annual congress of co-operators and of trade-unionists and is an intimate friend of most of the leaders of both these movements. Her bright, vivacious manner, charm of conversation and prepossessing appearance are sufficient to draw to her many friends. But work is to her the most important thing, and she now lives a quiet, almost secluded, life.

HOW THE FRENCH GIRL BATHES.

This is how the French girl bathes, that shy, demure, guarded ingenue, that white flower of girlhood, that bebe of 20 who only needs a muslin cap and rattle to be a baby of 2. First there is the dress parade on the beach, papa in his white flannel, mamma in her rouge and roses, the dear sainte de mousseline in sash and frills. They disappear after a little in the sentry boxes along the shore, and then reappear again draped in many-colored cloaks, and each showing below the cloak what the most reckless Narragansett Pier bather religiously covers, their ankles, bare and white.

A rope divides the women and men bathers, and there is a penalty dire for the man who dares cross the line or lay a desecrating digit on the ingenue bebe as she frolics in the waves in the bathing dress that the naughtiest girl-swimmer on the Atlantic coast could not be hired to wear here—a pair of short, close trousers of serge and a waist.

And the most startling thing about it is that the matron and maid, the corpulent father and stripling youth wear precisely the same costume, their legs below the knee guiltless of covering, and their gay cloaks hanging on the rope of division lend color and brightness to the scene.

And the shocked maiden who writes of this at great length in the *Table*, says that they are as guileless and innocent in their frolic in the surf as a lot of spoiled children on a holiday. No man may dare bathe his woman friend or teach her the principles of the swimming art as is done here in reckless, promiscuous America.

CULTIVATING FLOWERS.

Mrs. Theodosia B. Shepherd, of Ventura, Cal., who began the cultivation of flowers five years ago in a small way, has built up a large retail and wholesale trade, and her city gardens and greenhouses are famed throughout Southern California. She has in addition five acres of land under cultivation in the country. She superintends her business herself, attends to a large correspondence, and has recently made great improvements and added to her facilities.

AN ORANGE WATCH CASE.

An old invention, manufactured at the suggestion of a New York lady, is an enameled orange which opens and discloses a watch in one half and a purse in the other.

A prize of fifty dollars for the best original design by a woman of an article of furniture has been won by Miss Gertrude E. Fonda, of Vermont. A bookcase in form of a book was the shape she gave her design.—*The Evening Lamp.*

The Countess of Munster, a leader in English society, has written an article in which she says: "Our girls know too much," but the rest of her complaint shows that which she really means is that they know too little of the quiet graces, reserved manners, and simple ways of their mothers.

IMPROVED STONE-CUTTING SAW

French ingenuity has contrived an improved stone-cutting saw of remarkable efficiency—a circular-saw having its edges set with black diamonds in the same way as the straight blades, but as the strain on the diamond is all in one direction the setting can be made much firmer. Moreover, as the movement of the circular saw is far more rapid than that of the straight one the effect of the diamond teeth is increased by the force of the impact upon the object to be cut without the exertion of more power in propulsion. In order to keep this kind of saw at starting in perfect plane it is made to revolve between two pairs of guides, but as soon as the cut in the stone is deep enough to serve as a guide the temporary ones are removed, the consequence of this management being that the cut surfaces of the stone, instead of being wavy, so as to require subsequent dressing to a plane surface, are straight and smooth, lacking only to be polished. The stone to be cut is pushed against the saw by a carriage similar to that used in sawing wood, and the rapidity with which it is divided is very great. At one establishment where two saws are in use the green Alpine granite is sawed at the rate of nearly an inch a minute, hard marble at three inches a minute, and marble of moderate hardness, also hard limestone, four inches a minute.

RING BOILER PLATES.

The weakest part of a boiler is that where the plates are joined and riveted, and whatever the thickness or quality of plate, the joint between one plate and another is the test of its strength, says the *Marine Engineer* (London). Mr. John Windle of Barow-in-Furness took out a patent for a mill to produce these plates, and a plant will soon be erected to manufacture ring boiler plates or shells. It is proposed to make the ring plates from 12 to 16 feet diameter and 5 feet wide. The rings will have flanged ends and can easily be turned so as to make accurate fittings. It is claimed that boilers made from the new plates will stand 250 to 300 pounds pressure.

WORLD'S FAIR NOTES.

More than 15,000,000 feet of lumber will be used in the construction of the huge building for Manufactures and Liberal Arts, at the Columbian Exposition.

The foreign commissioners—Sir Henry Wood and James Dredge of England, Herr Wermuth of Germany and Dr. Emil Meyer of Denmark,—are greatly impressed and pleased at the building plans and extensive preparations for the Exposition. Said: Mr. Dredge "I have examined the plans very carefully. They contemplate the erection of magnificent buildings. They are bold, striking and, I may say, far in advance of our anticipations. From an architectural point of view I do not believe they could be improved. And I am assured that the landscape effects will be in harmony with the architectural features. Mr. Olmstead is the greatest landscape engineer in the world. The work he has done for the World's Fair shows that."

A reproduction of Independence Hall is now proposed as Pennsylvania's building at the Exposition. Prizes of $1,000, $500 and $300 have been offered for the best plans for a state building but it is thought the state commission will seriously consider rejecting them all and reproducing Independence Hall instead.

American jewelers are contemplating the project of massing their exhibits at the World's Fair, believing that a more effective showing can be made in that manner. The matter is not yet decided. Foreign jewelers are preparing to make an exhibit of unprecedented extent and value.

The Washington Park Club is perfecting arrangements for a most notable race meeting in 1893. The stakes in the American Derby that year are to be $50,000; in the "Queen Isabella" one mile for three-year-old fillies, $25,000; in the "Columbus Handicap" for three-year-olds and upwards, $25,000; in a race for two-year-olds, $25,000; and large stakes will be provided for a number of other races. The racing track is close by the World's Fair grounds.

M. O. Jaensch of Wahoo, Neb., writes to Chief Allison offering to the Columbian Exposition a valuable collection of arms. The collection includes 100 pieces, including swords, pistols, guns, etc., being a complete showing of all the different swords and firearms made from the time of the invention of gunpowder down to the Franco-Prussian war. Mr. Jaensch says the collection was left him by will. He offered it to the Exposition without cost.

Lieutenant Baker, special commissioner for the World's Fair to Mexico, reports that Mr. Berringer, a prominent merchant and land holder in Tabasco, will send to the Exposition a magnificent collection of the cabinet woods of Mexico. At the Paris exposition Mr. Berringer exhibited one hundred varieties of the finest cabinet woods, but at Chicago he promises to increase his collection to more than two hundred samples and show a specimen of every variety of cabinet wood in the republic of Mexico.

Lieutenant Safford has secured two large, full rigged "balsas," such as are used by the Indians of Lake Titicaca in their commercial trips along the shores. These balsas will be sent to the World's Fair, together with an interesting collection of musical instruments, weapons and wearing apparel of the Titicacans.

The Agricultural and Arts Association and the Stock Breeders' Association of Toronto have voted to urge the officials and government of Ontario to take measures to have the province properly represented at the Columbian Exposition.

The National Brick Manufacturers' Association has appointed a committee of five to secure an international exhibition of clayworking machinery for the World's Fair, and the committee has issued an address inviting the views of the trade.

A convention of representatives of the militia of the different states of the Union will be held in Chicago Oct. 20 to discuss and take action upon the question of a proper military display during the dedicatory ceremonies of the week of Oct. 12, 1892. The delegates, one from each state, have been appointed by their respective governors upon invitation of the Exposition committee on ceremonies. A full attendance is assured.

J. H. Laing, Jr., of J. H. Laing & Sons, florists of London, after a talk with Chief Thorp of the Floriculture division, became a World's Fair enthusiast, and offered to donate 10,000 begonias and send over two men to care for them during the Exposition. Chief Thorp says that he thinks $500,000 worth of orchids will greet the eyes of visitors on the opening day of the Exposition.

New South Wales, Australia, has decided to participate in the Chicago Exposition, and has appointed a commission of twelve to collect exhibits.

Exposition stock subscriptions have now been paid in to an aggregate exceeding $3,000,000 although only 60 per cent has thus far been called for. The $5,000,000 of city bonds voted by Chicago are now available and will be put on the market soon.

No Japanese goods or exhibitions will be permitted at the Exposition unless they have first received the approval of the Japanese officials in charge of their government exhibit. The Exposition Directory rendered this decision at the request of Japanese Minister Mutsu, who is the Japanese imperial commissioner to the Fair. A similar rule will be enforced in the case of other foreign nations.

NEW ENTERPRISES.

COLORADO.

George O. Garnsey has plans under way for an office and store building, for John Norris & Co., Pueblo, Col. It will be four stories and basement high, 70x100 feet in area, with pressed brick, stone, and iron fronts, steam heat, elevator, and interior work of Georgia pine. It will cost $60,000.

ILLINOIS.

Waukegan is doing well. A number of new factories will be located in the neighborhood of the Washburn-Moen plant before January 1st.

A number of factories have selected Chicago Heights as their location and will shortly start building.

Charles Thisslew of Chicago, has plans and specifications for a furniture factory for Kankakee, Ill., the plant to comprise various two and one story buildings of brick and stone, covering 60x400 feet of ground space, and completely equipped with machinery and two elevators; cost $25,000.

Sycamore has secured the location of the Chicago Insulated Wire Company. This company manufactures all kinds of insulated wire for electrical purposes, and will give employment to 125 hands. Sycamore gave them a bonus of $12,000 and four acres of valuable land adjacent to two railroads. The bonus was raised by selling 100 lots at $200 each.

Chicago.

The great freight ware-house scheme planned for the Northern Pacific land at Twelfth street and the river is reported to be in a fair way to be carried out. The plans have been finished, and work, it is claimed, will begin early in the spring. According to the present expectations the buildings contemplated will cover about thirty-two acres, extending from Taylor street south to Sixteenth street. They will be six stories in height and will be furnished with hydraulic elevators for raising the cars to the different floors. The total number of these warehouses will be over 150.

A four-story factory, 41x168 feet, will be erected on Sixteenth street, near Western avenue, for the Gilbert & Bennett Manufacturing Company, from plans made by S. G. Hallberg. It will be constructed of common brick and cost $30,000.

The promoters of the new printers' and publishers' office building on Plymouth place report favorable progress on their scheme. They say that several prominent trade journals and other periodical publications have already agreed to take ninety-nine year leases of floor space, and that it is quite probable that more ground will be obtained and the building made larger than originally contemplated.

Adler & Sullivan have designed a large addition to the factory of Brunswick, Balke & Co., at Superior and Sedgwick streets. It will be six stories high, 100x85 feet, and will be constructed of brick and stone, the interior being of mill construction. It will cost $35,000, and work will be commenced at once.

The Heath & Mulligan Manufacturing Company will soon erect a new factory on Seward street, between Eighteenth and Lumber streets, from plans prepared by W. W. Boyington. The factory will consist of four stories and basement, the area covered being 200x200 feet. The front will be pressed brick with buff Bedford stone dressings, and composition roof. The interior will be of mill construction, and especially adapted for the manufacture of paint, which will here be turned out in large quantities. Estimated cost $50,000.

Elgin.

Elgin did not get the Bucyrus dredge concern, but it was because a location on Lake Michigan was desired. If an inland city had been selected it would doubtless have been Elgin. Now there is a possibility of securing a hardware manufactory from Buffalo, N. Y. It employs 500 hands, and wants to come to Elgin. It would seem to be with it a mere matter of bonus in deciding the matter.

The Dickie Label Works are not yet in running order, but building additional to the original design is being done. Contracts have been let for an-

other structure, 156x36 feet in size, and plans are being prepared for still another. The buildings now up will soon be ready for occupancy.

Next season it is the intention of the watch company to build a natatorium at the rear of its mammoth boarding-house. The watch company has in many ways provided for the comfort and enjoyment of its operatives.

Kankakee.

The Gibbs Chair Company are building a large new factory here, consisting of two new buildings, 75x250, with power houses attached.

Horn Bros. of Chicago, are building a new furniture factory in Kankakee.

Turk & Voss of Chicago, are also building a new factory in this town.

INDIANA.

Jay Dwiggins & Co. have just closed a contract with G. G. Williams, formerly of West Branch, Mich., to locate at Griffith, Ind., his woodenware factory, working thirty to forty hands. It will be in operation by Dec. 1,1891. Eight car-loads of machinery and material have already arrived, and the construction of his two-story, 60x80, factory building is under way. The site selected for this factory is just across Junction avenue, west of block 3, Dwiggin's addition, and on the line of the Chicago & Erie and Michigan Central railroads.

The Calumet Varnish Company of Brooklyn, N. Y., will locate at Tolleston, Ind. The company has purchased five acres of land in Section 16 adjoining the Pittsburgh, Fort Wayne and Chicago Railroad, at $825 per acre. The main building will cost $14,000. The several minor buildings and the large tanks for the storage of the varnish and oil will cost $23,500, making the total cost of the plant, exclusive of the price of the land, 37,500. The product of the company is varnishes, hard oils, japans, etc., it is estimated that the output will be $300,000 worth of material per year, which will require the the work of 200 men. The incorporators of the enterprise are John Marples, G. M. Gilbert and C. P. Allen all of Brooklyn, N. Y., their offices and warerooms will be located in Chicago.

NEW YORK STATE.

The old Hutton Brewery, Utica, N. Y., will be started upagain by a new company. They will purchase ice machinery, pumps, etc.

Brick manufacturing is becoming very active in and near by Syracuse, N. Y. A new plant is about to be built at Liverpool near that city.

The Consolidated Street Railway Co. of Syracuse, N. Y., will build a power plant early in the spring.

PENNSYLVANIA.

Jul de Horvath of Chicago, has competitive plans in progress for the new Carnegie Library building, to be erected in Pittsburgh, Pa. The elevation presents an imposing edifice in the Romanesque style, four stories high, and covering an area of 400x360 feet. The material used in the facades will be Minnesota and Dakota stone, with slate-covered towers and turrets. The interior will contain a large music hall capable of seating 2,000 persons, an art gallery, library, and various other rooms, all beautifully finished and decorated, heated by steam, and illuminated by electricity, the whole to cost $700,000.

LITERARY.

The Franklin Institute's "announcement and program of lectures" for the coming season is in a very nea pamphlet form. It contains a list of the officers and managers, with ahistory of the Institute and its *Journal.*

The Buckeye Engine Co., Salem, O., have issued a new pamphlet, being their "first circular matter upon the subject of multipie-cylinder engines." In addition to an exhaustive treatise on the Buckeye compound engines, fully illustrated, there is appended a comprehensive table showing the properties of steam from 1 lb. to 150 lbs. absolute pressure on the square inch. For instance, the temperature of steam giving 10 lbs. pressure to the square inch is 193.3 degrees Fahr.; and it has 979.3 thermal units of latent heat of vaporization, with 1,141.0 total heat of vaporization above 32 degrees, while the weight of a cubic foot of such steam is .02644 lb.

BUSINESS REPORTS.

An average shipment of four air compressors per week is the record of the Clayton Air Compressor Works, of 43 Dey St., New York, during the past two years. In addition to air compressors for use in mining, tunneling, etc., numbers have been sold for aerating crude petroleum for fuel, elevating acids and working pneumatic riveters. The Clayton air compressors are so well known, and their reputation so long and well established, that any extended description of them is superfluous; and we would simply say that several new and important improvements have been made, prominent among which is the patent combined governor, which regulates the speed of the compressor and the pressure of the air at the same time and without attention from the engineer in charge. Any one requiring compressed air for any purpose would do well to write the makers for catalogue and information.

The Patent Brick Co., San Francisco, Cal., has ordered a 150 h.p. tandem compound condensing engine, one 200 h.p. Stewart purifier and heater, and one 200 h.p. Wheeler independent pump and Admirality surface condenser from the Ball Engine Co., Erie, Pa.

Mr. H. Bloomfield, San Francisco, Cal., has ordered a 150 h.p. compound condensing engine from the Ball Engine Co., Erie, Pa.

The Wheeler Condenser and Engine ,Co., notify us that they have purchased the entire plant and business, including drawings and patterns, of the Colwell Iron Works, (as stated in our last issue), located at Carteret, N. J., (offices at 74 Cortlandt street, New York,) and have also purchased the patents and good-will of the condenser business of Mr. Fred'k Mer'am Wheeler, who has the reputation of being the leading engineer of the country in steam condensation and kindred specialties; and he will continue to give the new company the benefit of his valuable experience and professional assistance. They have also secured the services of Mr. William Porter, a well known mechanical engineer of experience, and who was for many years superietendent of the Colwell Iron Works, and for the past year general manager of the Chester Foundry & Machine Co.

Mr. E. G. Gilbert, Atchison, Kas., representative of the Ball Engine Co., Erie, Pa., is erecting a 40 h.p. steam plant consisting of 40 h.p. engine, boiler, heater, pump, etc., for the Norfolk Street Railway Construction Co., Norfolk Neb. He also set up a 35 h.p. engine for the Norfolk Beet Sugar Co., Norfolk, Neb.

The Ball Engine Co., Erie, Pa.. have shipped the World' Fair one 60 h.p. engine for operating the incandescent electric light plant on the grounds.

The machine shop, iron foundry, brass foundry, and pattern shop of the extensive plant at Carteret, are of the most modern constrnction and equipped with the latest improvements including traveling cranes, etc. Each department is in charge of a foreman of thorough training and experience, and only skilled workmen find employment there. The shipping facilities are of the best. A branch track of the New Jersey Central Railroad enters the premises, so that they can ship direct to any point in the country. With a water frontage of 750 feet, on Staten Island Sound, and docks equipped with proper cranes, they can load vessels for any port. Capacity of foundries 1500 tons per month. Carteret is within 15 miles of New York City.

The Wesleyan University, Middletown, Conn., are installing a 25 h.p. engine built for them by the Ball Engine Co., Erie, Pa.

The Johnson Co., Johnstown, Pa., have recently ordered from the Ball Engine Co., Erie, Pa., a 60 h.p. engine —being the 22nd engine built by them for the Johnson company, aggregating over 3000 h.p.

WATERWORKS CONTRACT.

Butler, Indiana, lets a contract for constructing its waterworks, Oct. 19, 1891.

SITUATION WANTED

As engineer, by a thoroughly experienced and reliable man, highly recommended. Address "Steam," care of The American Engineer, 1302 Pontiac Building, 358 Dearborn street, Chicago.

CONTRACTS OPEN.

Pumping Machinery.—Sealed proposals will be received by the Board of Water and Lighting Commissioners of the city of McKeesport, Pa., until noon on the 5th day of November, 1891, for the furnishing and erection of two (2) three million galion horizontal dupiex direct acting, compound coudensing, or non-compound condensing, rotative pumping engines, of the outside center packed water plunger pattern, for the McKeesport Water Works; together with all appurtenances and connections thereto, as set forth in the specifications for said engines, now in the office of the Superintendent of Water Works.

Said Board of Commissioners reserve the right to reject any or all proposals.

Copies of specifications will be mailed upon application. All proposals shall be endorsed "Proposals for Pumping Machinery" and directed to the undersigned. By order of the Board. Jos. Ecoff, Superintendent.

Approaches to U. S. Court House, Etc.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock p. m. on the 5th day of November, 1891, for all the labor and materials required for the approaches to the U. S. Court House and Post Office, at Texarkana, Ark. Texas, in accordance with the drawing and specification, copies of which may be had at this office, or the office of the Superintendent at Texarkana, Ark., Texas. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply striotly with ali the requirements of this invitation. Proposals must be inclosed in envelopes, sealed and marked, "Proposals for the Approaches to the U. S. Court House and Post Office building at Texarkana, Ark., Texas," and addressed to W. J. Edbrooke, Supervising Architect.

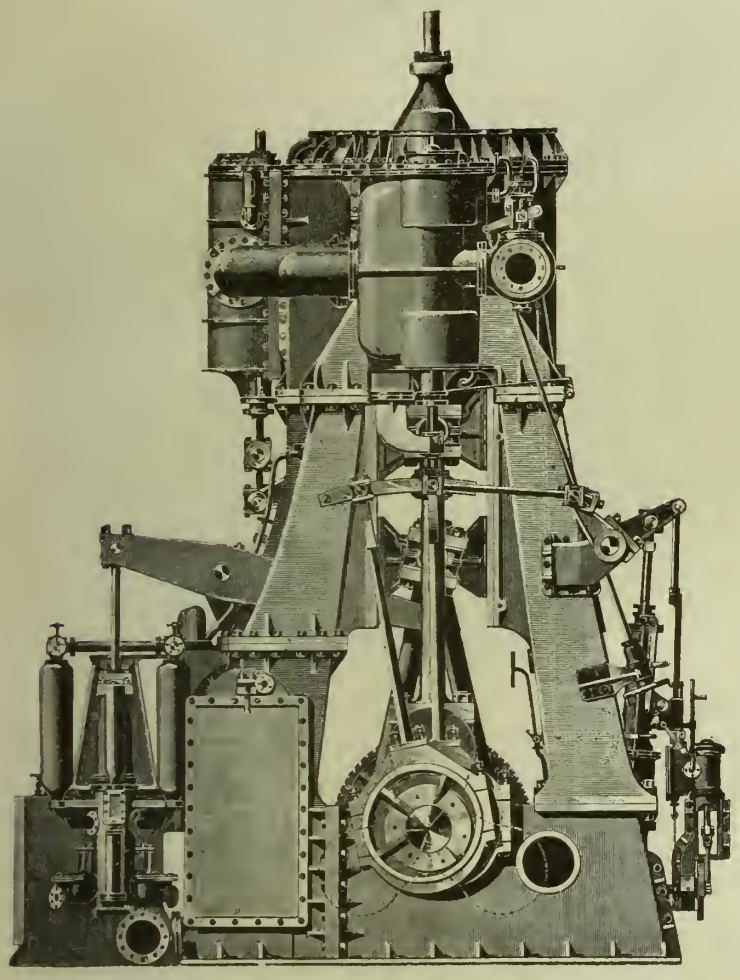
Steam Heating Apparatus.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock p. m. on the 26th day of October, 1891, for all the labor and materials required to remove the old heating apparatus, and fix in place complete a new low-pressure, return circulation, steam-heating apparatus for the U. S. Custom House building at Cairo, Ills., in accordance with drawings and specifications copies of which may be had on application at this office, or the office of the custodian of the building at Cairo, Ills. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal. The department will reject all bids received after the time herein stated for opening the same; also, all bids which do not comply strictly with all the requirements and meaning of this invitation. Proposals must be inclosed in envelopes, sealed and marked "Proposals for the New Low-Pressure, Return-Circulation, Steam Heating Apparatus for the U. S. Custom House, at Cairo, Ills., and addressed to W. J. Edbrooke, Supervising Architect.

United States Engineer Office, 34 West Congress street, Detroit, Mich., September 19, 1891. Sealed proposals, in triplicate, will be received at this office until 2 o'clock p. m., October 19, 1891, and then opened: For furnishing ten gate anchorages for the 800 feet lock at St. Mary's Falls Canal, Michigan. Preference will be given to materials of domestic production or manufacture, conditions of quality and price (import duties included) being equal. Attention is invited to Acts of Congress, approved February 26, 1885, and February 23, 1887, vol. 23, page 332, and vol. 24, page 414, Statutes at Large. The government reserves the right to reject any or all proposals; also, to waive any informalities. For further information apply at this office. O. M. Poe, Colonel Corps of Engineers, Bvt. Brig. General, U. S. A.

OCTOBER 24, 1891. The American Engineer. VOL. 22, NO. 17.

NEW TRIPLE EXPANSION ENGINES.

Engravings of two handsome new steamers built by Barclay, Curle & Co., Ltd., Glasgow, for the Castle Mail Packet Company, for their South African business, have recently appeared in *Engineering*, from which the accompanying illustrations and description of the engines and steamers are taken.



"Docne Castle" and "Lismore Castle" Engines.

The principal dimensions of the two new steamers are as follows: Length over all, 410 ft.; breadth 43 ft. 3 in.; depth, 31 ft.; and the gross register tonnage of each vessel is 4050 tons. They are built beyond the rules of Lloyd's Register, the material used for the hull being Siemens-Martin steel. They are constructed upon the cellular double-bottom principle, without any wells leading into the hold, and thus the maximum amount of safety is obtained. They are divided into nine water-tight compartments by transverse bulkheads from the top of the double-bottom to the upper deck, and have two complete steel water-tight decks, in addition to which they have powerful, double-acting duplex steam pumps connected with an elaborate system of piping, extending to double-bottom and bilges of the cargo holds. These pumps may be supplied with steam either from the main or donkey boilers.

These steamers are to take up what is known as the intermediate combined passenger and cargo service between London and the Cape.

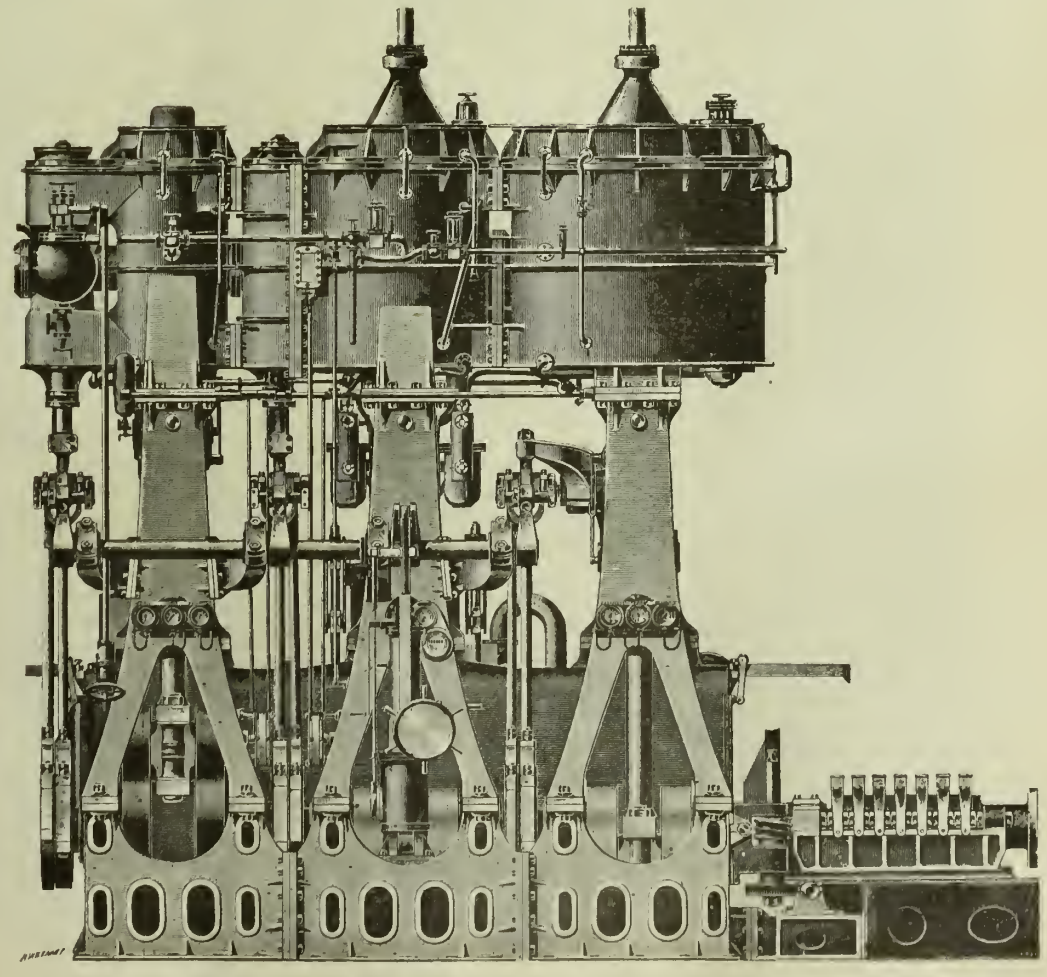
The lighting is by electricity, the plant having been supplied by Messrs. Siemens Brothers, while the dynamos are driven by Allen's direct acting compound engines. The installation includes mast. head and signal lights, diving and search lamps. The engines work at 200 revolutions. Electric bells are fitted throughout the vessels. Messrs. Haslam, of Derby, have supplied refrigerating engines to give 8000 cubic feet of cold air, and the engines are connected to two cold chambers. For the auxiliary machinery, winches, pumps, windlass, and steam capstans, there is, in each ship, a large multitubular boiler, with separate air and circulating pumps, so that all the auxiliary machinery is independent of the propelling engines and main boilers.

Each vessel is fitted with triple-expansion three-crank engines, of which engravings are given herewith. The diameters of cylinders are as follows: High-pressure, 29½ in.; intermediate, 48 in.; low-pressure, 78 in.; the stroke being 54 in. The working pressure is 160 lb. per square inch. The high-pressure cylinder is fitted with a piston valve taking steam at the middle and exhausting at both ends. The intermediate cylinder has the usual double-ported slide valve, and the low-pressure cylinder a double-ported slide valve, Thom's patent, placed at the back of the low-pressure engine and worked by a strong cast-steel lever, thus reducing the over-all lengths of the engines and making a very compact design. The reversing gear is Brown Brothers' steam and hydraulic type, with hand gear combined. The steam supply is regulated by a double-beat stop valve worked from the starting platform, while there is a separate throttle valve, worked by Dunlop's governor. The crank-shaft is built up and arranged in three separate and interchangeable pieces bolted together.

The air, circulating, feed, bilge, still, and sanitary pumps, are all worked by levers driven off the crosshead of the intermediate pressure engine, and are all arranged to give easy access for working. Besides these pumps there are fitted a large pump and feed heater. There is a centrifugal pump by Tangye for ballast tanks, and it is also arranged to draw from the sea and discharge sufficient water through the condensers to enable the engines to run at full speed in the event of the ordinary circulating pump giving way. A large suction valve is also fitted to draw water from the bilges in the event of a leak. A duplex auxiliary pumping engine is fitted to feed the main and donkey boilers and to circulate water in getting up steam in the main boilers, to supply water for deck service, and pump out bilges and ballast tanks when the centrifugal pump is not available. A Weir's evaporator is fitted, to make about 14 tons of fresh water per day for the boilers, and in addition it has a connection with two large Chaplin's distillers so arranged that the steam evaporated from the sea water can be used as drinking water. Steam engines are fitted for hoisting ashes in each stokehold.

Steam is supplied to the engine by two steel multitubular double-ended boilers, each 14 ft. 9 in. in diameter by 18 ft, 8 in. long. There are six Fox's corrugated furnaces in each boiler, with a separate combustion chamber for each furnace. There are thus twelve furnaces in all, each 3 ft. 4 in. mean diameter.

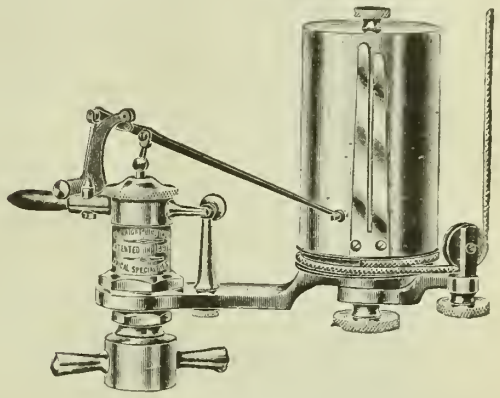
The speed attained when running "the lights" on the Clyde was 14·4 knots, the indicated horse-power being 3250, and the number of revolutions 75. The propeller is of steel with four blades, the diameter being 18 ft. 6 in. and the pitch 21 ft. 6 in.



Triple Expansion Engines of "Doune Castle" and "Lismore Castle."

THE STRAIGHT LINE INDICATOR.

The peculiarity of this indicator lies in the simplicity of its parallel motion and in the auxiliary spring, by which it is held up to one working surface and thus prevents the appearance of any backlash. The guiding mechanism for the parallel motion is placed as near the fulcrum as possible, to obviate the great amount of movement as found in other indicators, and to be where the momentum will be the least. For a card of average height, a sideways movement of not more than one eighth of an inch is necessary to oblige the pencil to move in a straight line, and for so slight a movement, very little mechanism should be sufficient.



Straight Line Engine Indicator.

The first indicator made was subjected to the test of being run continuously, nine hours a

day on a high speed engine, for over a month, and showed no appreciable wear, as what may have been was taken out by the auxiliary spring, and the instrument improved, if anything, by this usage.

The effect of the auxiliary spring on the main spring is to weaken it. This allowance is made in numbering the spring, and the scale of spring therefore is the net resistance of the two springs.

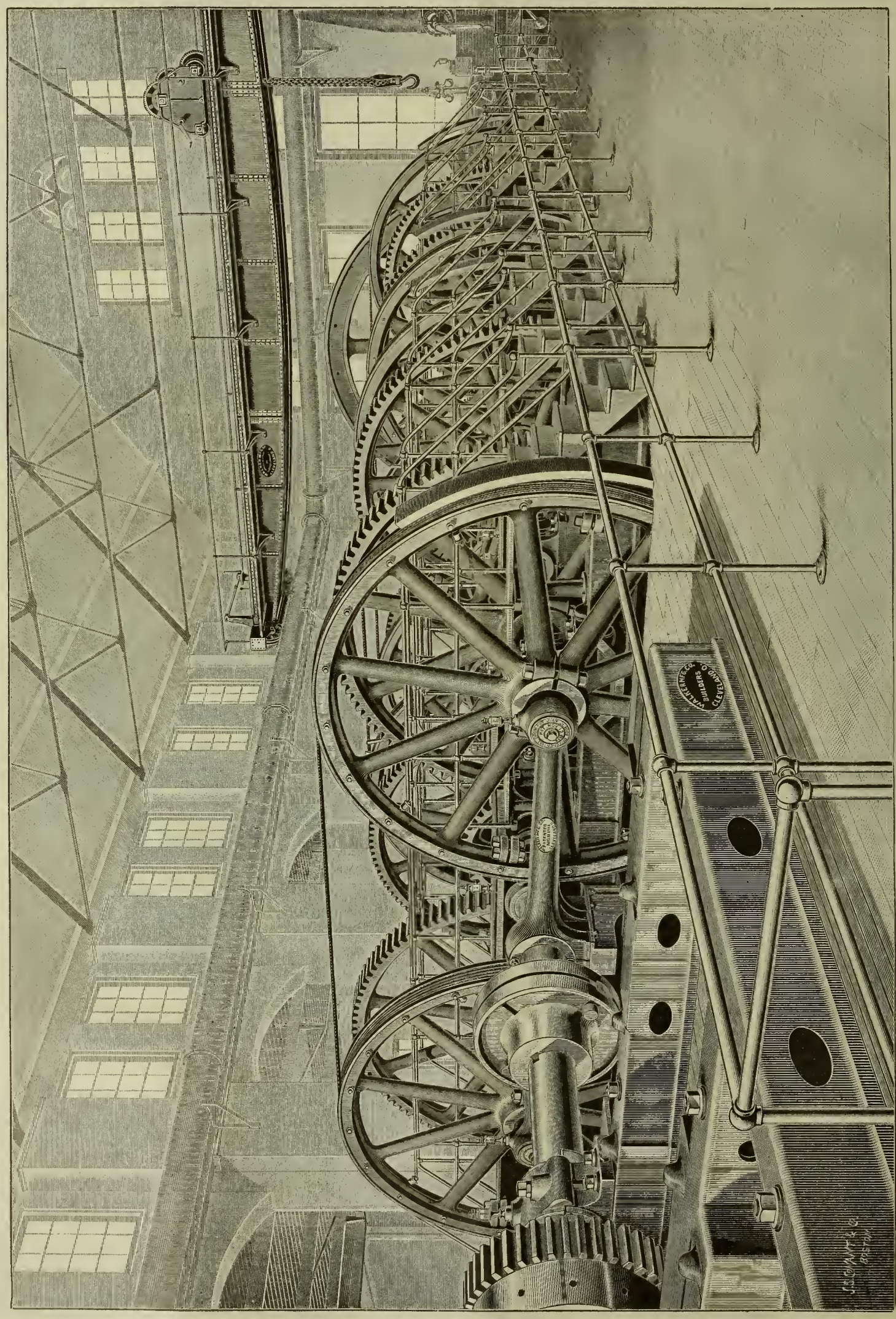
The moving parts of the instrument are the lightest weight of any straight line indicator, and that weight is disposed so near the fulcrum that its little movement makes the momentum very little and especially adapts it for the highest speeds.

This excellent indicator is obtainable from the well-known dealers in steam specialties, Hine & Robertson, 45 Cortlandt street, New York, from whom any further information desired may readily be obtained.

WALKER CABLE-DRIVING MACHINERY.

The accompanying engraving affords an excellent illustration of the driving machinery of one of the best cable-railway power horses in the country, being that of the Cleveland (Ohio) City Cable Railway Co.

The interior view here given shows the driving machinery, which was built by the celebrated



Walker Mf'g. Co's Driving Machinery for 6-Cable Plant, Cleveland (O.) City Cable Railway.

Walker Manufacturing Co., of Cleveland, as well as the overhead crane and tension carriages.

This driving machinery operates six cables, running at various speeds: those at sixteen miles an hour being driven by drums sixteen feet in diameter; a couple going at a speed of twelve miles an hour are driven by fourteen feet drums; and those going at the rate of only six miles per hour, one mile in ten minutes, are driven by means of auxiliary machinery (also constructed by the Walker Manufacturing Co.) which is located some distance from the central station.

The design of the auxiliary machinery is similar to the drums of the driving plant and occupies a space below the surface of the street about thirty by ninety feet, the street being supported by means of steel I beams with brick arches laid in cement mortar. The main Superior Street cable, at a speed of twelve miles per hour, enters the vault, thence with half wraps embraces two twelve-foot overhanging driving drums, thence to an end sheave in the same vault, and by the south track tube returns to the power station. The shafts of the auxiliary drums are provided with pinions four feet in diameter with ten-inch face, which engage with gear wheels ten feet in diameter having the same width of face, which are mounted on the shafts of the auxiliary driving drums which are also twelve feet in diameter, all the shafts being ten inches in diameter. The initial drum shafts are also provided with friction clutches. By the arrangement as described above the speed of the auxiliary cable is normally six miles per hour. From the auxiliary drums the cable passes to a tension carriage, with twelve-foot horizontal sheaves mounted on an incline of twenty degrees in the same pit. The auxiliary machinery is mounted upon cast iron girder frames resting upon brick foundations, the side section of the frames being 12×14 ins. and provided with adjustable pedestal boxes. All the drums are overhanging, with struts.

All this machinery is driven by two engines furnished by Wm. Wright, of Newburg, N. Y. Each is capable of developing 1,500 h.p. The two engines are generally running together, but either of them may be made to drive the entire plant alone if necessary. The cylinders of these engines are 38×60 ins., and designed to make 65 revolutions per minute. Each fly-wheel is 24 ft. in diameter, and weighs 125,000 lbs.

The steam is generated in three 420 h.p. Babcock & Wilcox boilers, in which crude oil is used for fuel, the oil being delivered to the furnace in the form of a spray under a pressure of from five to eight pounds, and at the burners it is combined with a small jet of live steam from the boilers.

"OTTO" KEEPS THE LEAD.

Schleicher, Schumm & Co., engineers and builders of the "Otto" gas engine, Philadelphia, say:

Our German correspondents inform us that at the Strasburg Industrial Exposition, where an unusually large number of gas engines of all makes and description, were exhibited, they alone were awarded for their "Otto" gas, gasoline and petroleum engines" the highest diploma and gold medal for superior design and workmanship.

Second prizes were given to Adam, Benz, Buss-Sombart & Co., Hille, the Kobers Iron Works, Escher-Wyss & Co.

Third prizes to Grob & Co. (Capitaine Petroleum Motor), Korting and Bitschweiller (Petroleum Motor.)

It is expected that there will be fully 3,000 dogs entered in the Exposition bench show. The various kennel clubs propose to supplement the already satisfactory premium list by a number of very handsome medals.

THE WESTON AUTOMATIC ENGINE.

The accompanying engravings give a good idea of the appearance and construction of the Weston engine* for which several points of superiority are claimed.

The bed is made especially heavy, having interior ribs running across and lengthwise in sufficient number to make it absolutely rigid and positively proof against any springing tendency, it is maintained. The guides are a fixed portion of bed, planed therein and accurately scraped. The cross-head shoe is adjustable to accommodate wear of any magnitude, and an adjustment will always leave the engine in correct alignment, it is said. The main bearings have adjustable check pieces to take up wear, and all bearings are sufficiently "generous" to satisfy the most radical advocate of large wearing surfaces. The reciprocating parts are balanced by weights in the crank discs. The cylinder and steam chest are in one casting and made from the best charcoal iron. The piston is made hollow and cast-iron rings are sprung in for packing. The cast-iron jacket allows the cylinder to be covered on outside with mineral wool to prevent radiation of heat.

The valve (Fig. 4.) is a single casting, with perfectly parallel faces, and works steam-tight between its seat and a heavy pressure plate. The steam being admitted to the center port (see Fig. 5), acts in

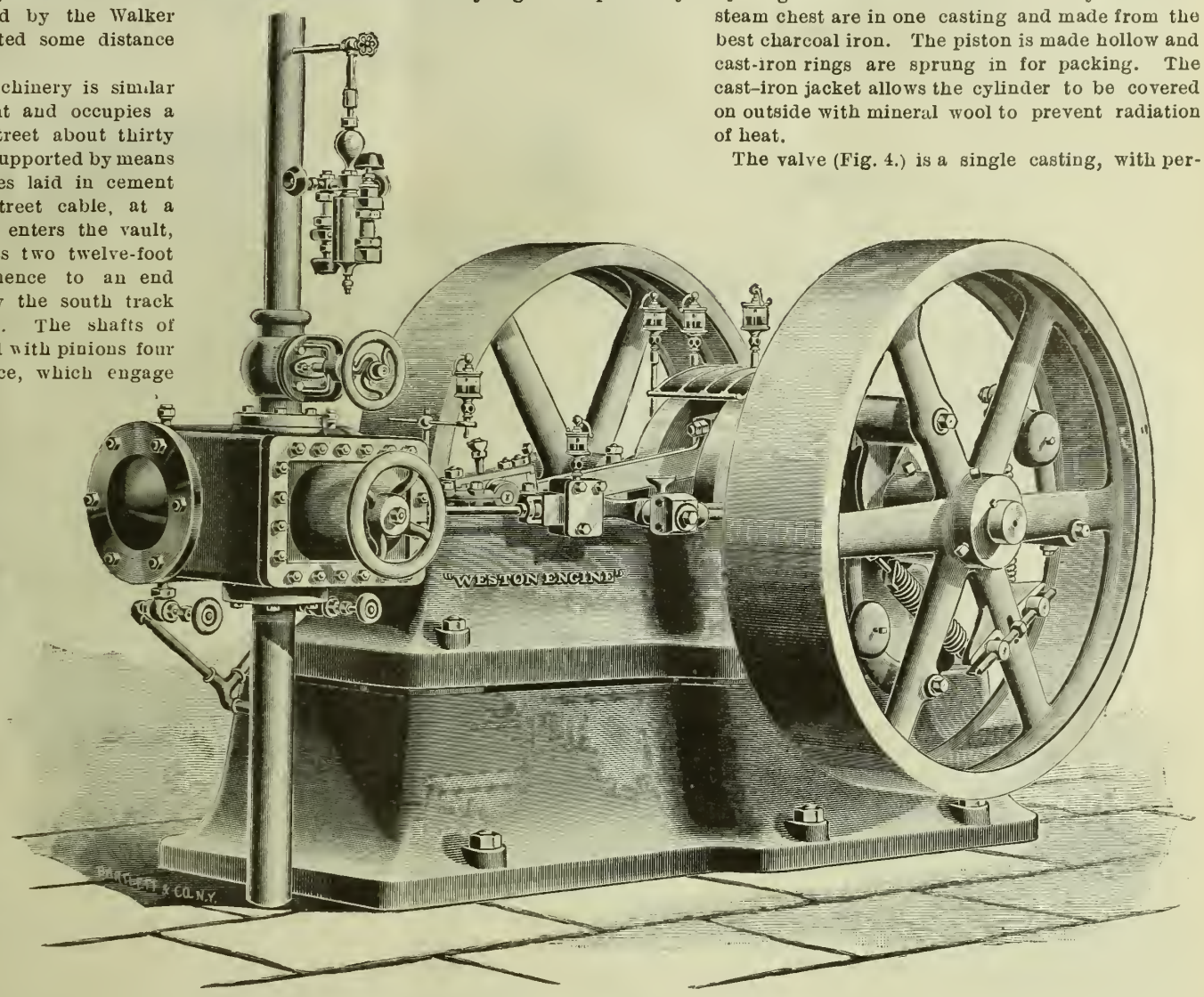


Fig. 1.—Weston Automatic Engine.

*Built by the Weston Engine Co., Painted Post, N. Y.

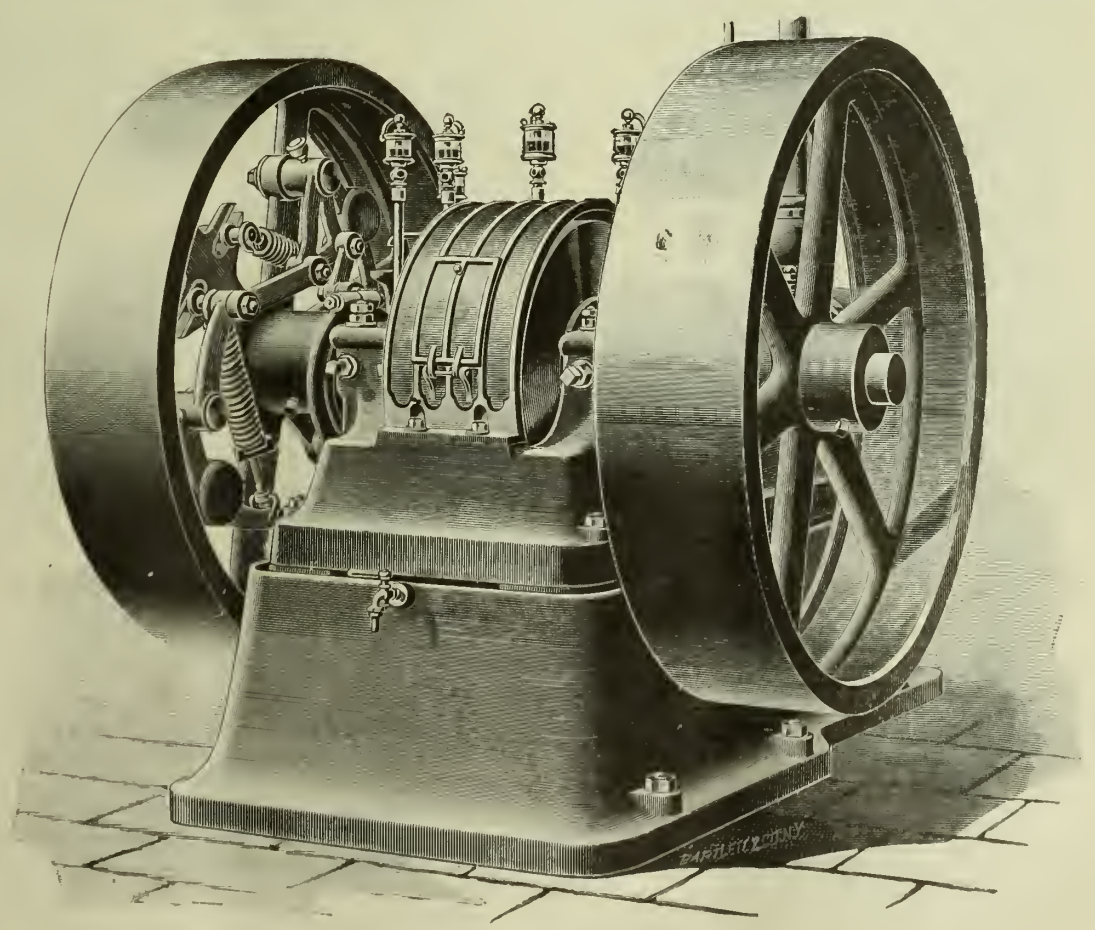


Fig. 2.—End View of Weston Automatic Engine.

direction to lift the pressure plate away from the valve, which it is prevented from doing by springs which rest against the end of a set screw that passes through the steam-chest cover and has a hand-wheel on the outside. This arrangement admits of spring the tension being varied if found necessary, and also allows the release of pressure plate from the valve when starting the engine, which is an important consideration. This arrangement does not prevent the valve lifting to relieve the cylinder of water, the same as an ordinary slide valve. The action of the valve is clearly shown by the cut, and gives four openings for the admission of steam, the length of each being equally the diameter of the cylinder. This, together with a large travel and ample ports, gives, as might be expected, a high steam line and a sharp cut-off. The exhaust is through a double opening and is attended with the same advantages that characterize the steam admission.

This form of valve, when properly fitted up, will keep tight for a long time, acquiring a beautiful polish and working without appreciable friction. Wearing down by its own weight does not open a

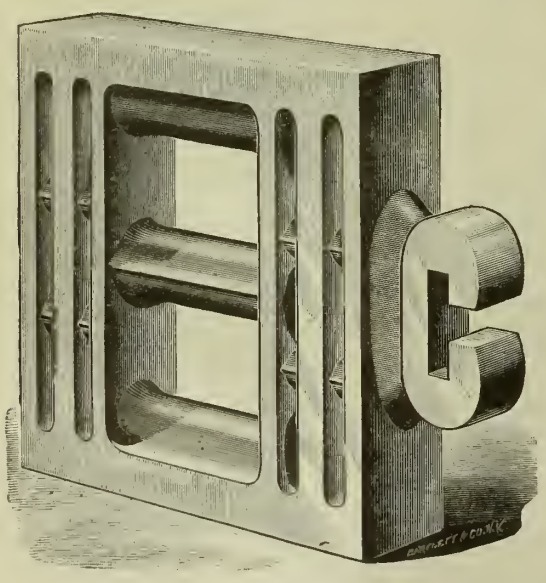


Fig. 4.—Valve.

eak, as in a piston-valve, and, when after long use, leakage does occur, it is readily taken up by the adjustable pieces which support the pressure plate. These distance pieces are composed of two wedges, fitted together, one of which is doweled to the steam-chest face, and has a projection on the end through which a set screw passes and enters the other wedge. It is by this screw that the adjustment for preventing leakage is made.

The piston-rod stuffing box, as shown in Fig. 5, is of a novel design, and remarkable behavior it is said. There is in it a large amount of packing which cannot be very tightly compressed; and, if properly packed, the steam pressing on the gland follows up the wear and obviates the necessity for adjustment, they say.

A further advantage, as the builders claim is obtained by allowing clearance between glands and body of stuffing box, so that any wear of cross-head shoe will not bring the piston rod to bear upon the glands, the clearance allowing the rod to assume any position without binding in the box.

The governor (Fig. 6) is of that class which has a laterally movable eccentric surrounding the crank-shaft of the engine, by which the admission of steam to cylinder is regulated through the variation of its throw. This variation is effected by the movements of centrifugally acting weights connected by levers to the eccentric, while the centrifugal motion of these weights is resisted by centripetally acting springs, the free ends of wich are attached to the weight levers, the other ends being

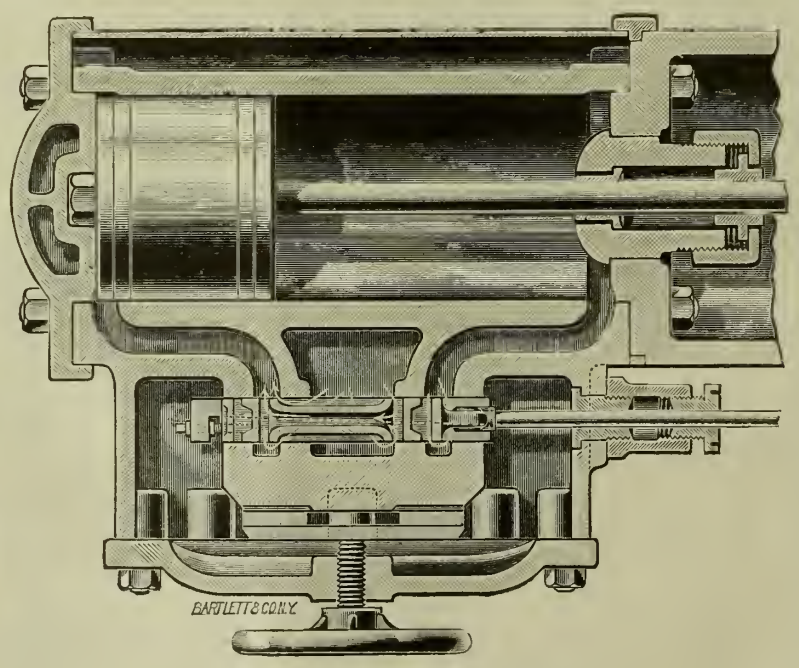


Fig. 5.—Section Through Cylinder.

attached in an adjustable manner to fly-wheel.

With the governor at rest the tension of the springs will hold the eccentric in position of the greatest throw, but in action the centrifugal force of the weights moves the eccentric across the shaft, reducing its throw as increased rotary motion takes place, until it reaches the point where the valve travel will be in accordance with the amount of steam necessary to drive the load. It is apparent that for any nicety of regulation, the centrifugal force and the centripetal force, as supplied by the weights and springs, should be in equilibrium This is a requirement very difficult to meet, and a further complication arises from the position of the eccentric constantly changing to accommodate the variable loads thrown on the engine, thus requiring the spring and weights to be in equilibrium at any possible position.

Centrifugal force increasing in a certain ratio makes it necessary to attach springs to wheels at points that will increase the tension, as springs are distended, in same ratio. These points of attachment cannot be found accurately by any method of calculation, and consequently the adjustable attachment must be resorted to, as the Weston Engine Co. point out. This enables one, in a very short time, by trial, to get the position of sensitiveness sought. It has been usual, heretofore, in this class of governors, when supplied with sensitizing device to accomplish adjustment from two points of the wheel, diametrically opposite. This arrangement is necessarily awkward, as it compels the turning over of the engine one-half revolution before effecting adjustment, which is often almost impossible; and adjustment cannot be made with extreme accuracy, as one may be placed at its sensitive point and the other sufficiently misplaced to counterbalance the efficiency of the first. A further disadvantage is in the unequal tension given to springs often causing breakage of either spring, from said spring having been made to overcome an undue proportion of the centrifugal force.

An inspection of the cut (Fig. 6) shows that these objectionable features have been overcome by an arrangement which allows both springs to have their attachment to wheel on the same side. This admits of a right and left hand screw, with nut in centre, being inserted in the two spring attachment pins, the turning of which moves simultaneously, and an equal distance, the two springs nearer to, or farther from, the pivotal points of levers, thus accomplishing the regulation of governor to a degree equaling isochronism if desired.

With a governor so adjusted that the centrifugal force is in exact equilibrium with the centripetal force the condition is very unstable, and the least disturbance resulting from any variation of load, speed, or friction of the valve reciprocating parts, will set up oscillations of the governor weights, which will swing rapidly back and forth through their whole range, and vary the speed of the engine accordingly. This is the condition known as "hunting," or "racing." To remedy this well known defect "dash pots" have been used, but owing to their sluggishness and the liability of the liquid leaking from them, they are a very poor remedy. Weston overcomes the difficulty by so arranging the weights with relation to the weight lever pivots and the points of attachment to the eccentric that their own inertia will destroy any tendency to vibration.

This governor has proven so effective, in all cases it is said that the Weston Engine Co. are prepared to guarantee a regulation within 2 percent. from friction to full load, and with any change in boiler pressure to a point so low that the engine must take steam 7-10ths of the stroke to do the work.

Fig. 8 represents the connecting rod, which is a steel forging, polished all over. The cross-head end is coustrncted so that brasses may be removed without taking out pin. This is accomplished by cutting out top of rod aud fitting on a cap which is held in place by two studs, thus making it fully as rigid as a solid end. These brasses are held tightly by the cap clamping them. They may be filed apart any amount to accommodate the full rauge of adjustment. This adjustment is made by loosening the nnts binding cap, and turning a screw that passes through the wedge-shaped iron block fitted between the brasses and rod butt. This screw bears at one end on the rod and at the other

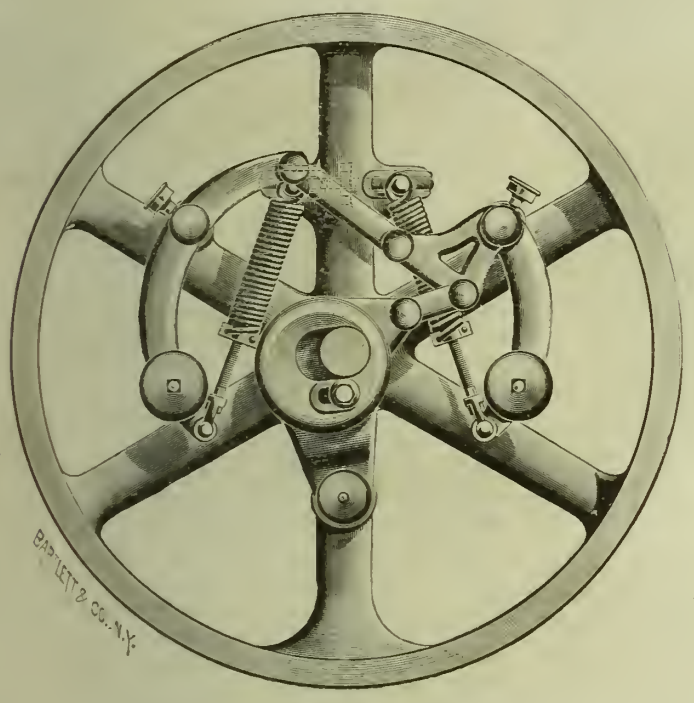


Fig. 6.—Governor. (Weston Engine.)

against nnderside of cap by the collar shown. A continnation of the screw passes through the cap and has a jam nut to lock it after adjustment, with a portion sticking through the nut, having a hexagon cnt thereon, allowing the use of a standard wrench for the operation of screw, the turning of which will move brasses nearer to or further from the pin.

The crank end is a box with cap, attached to rod in the manner shown. Adjustment is made by removal of a liner, or filing distance pieces on cap.

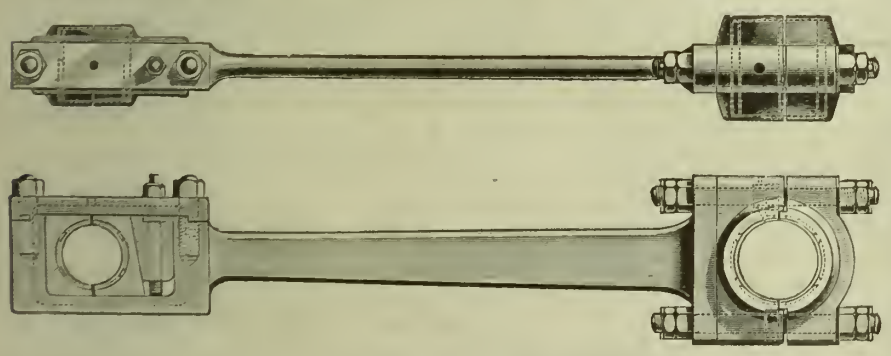


Fig. 7.—Weston Engine Connecting Rod.

This is made very accessible by placing a door in crank oil-guard, throughwhich wrenches can be introduced and adjustment easily made, when necessary.

This rod maintains a permanent length,or so nearly so that the difference is inapprcciable, the variation being only in the amount one box wears more than the other. This requires less clearance in the cylinder as the piston always remains in the same place.

The oiling devices are very complete, every bearing being oiled from stationary sight-feed oil cups, and they also can be oiled from oil-can while in full motion. The oil wasting from the boxes on the inside is caught in annular rings on sides of crank discs provided for that purpose, while on the eccentric side a snap ring is sprung over crank shaft and extends inside of eccentric, which serves as an additional means of lubricating that part, as the oil running to the ring is thrown off by centrifugal force and passes through holes in the eccentric to the eccentric strap, shown in Fig. 8.

Oil flying from cranks is caught by a cast-iron oil guard and carried to bottom of bed, from which it is taken by channels in the oil plate, or sub-base, whichever is used, to a general oil receptacle, from which it can be removed and filtered.

THE ROOTS PNEUMATIC SLACK REMOVER

The P. H. & F. M. Roots Company, of Connersville, Ind., have a new scheme for removing slack. And the accompanying illustration shows a plan of their plant at the mines of the Consolidated Coal and Mining Co., at Brashears, O., which is a sample of "the future method by which refuse and slack coal will be elevated and transported at elevators and coal mines."

Miners and shippers of coal, all over the country, feel a pressing need for some method by which the slack coal at elevators and mines can be moved rapidly, in large quantities, and at the same time more economically than the present or old method of hauling it by means of horses and carts, which is expensive; and the method hitherto in vogue is said to be entirely "out of sight" when compared with the Roots pneumatic refuse and slack remover.

One of the difficulties in perfecting the new device was in getting a reliable feed arrangement. This has ultimately been overcome; and the scheme has been thoroughly tested and is covered by letters patent

The new refuse and slack removing plant comprises a Roots positive blast blower, and suitable engine combined on same iron bed-plate, with feed attachment as shown in the illustration; also the necessary length of pipe to convey slack to the dump or the point of discharge. The hopper in which the slack is finally discharged in elevator, is connected with the feed and the slack forced into the blast pipe and carried to its destination by means of the blast of air from the blower. The plant is very simple to operate and in cases where

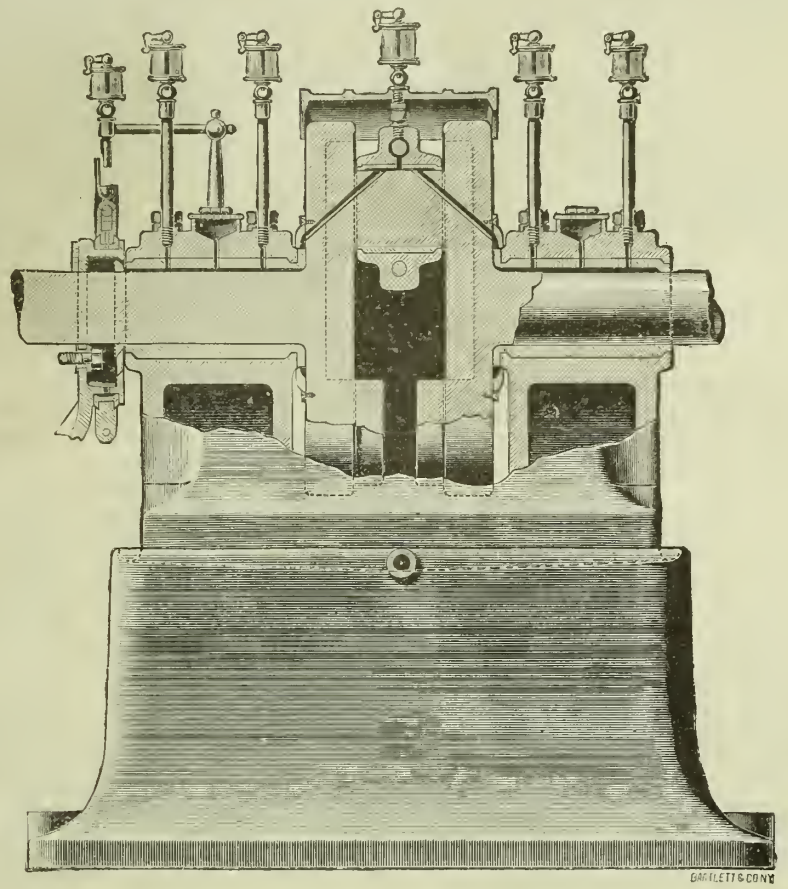


Fig. 8.—Section Through Crank Shaft. (Weston Engine.)

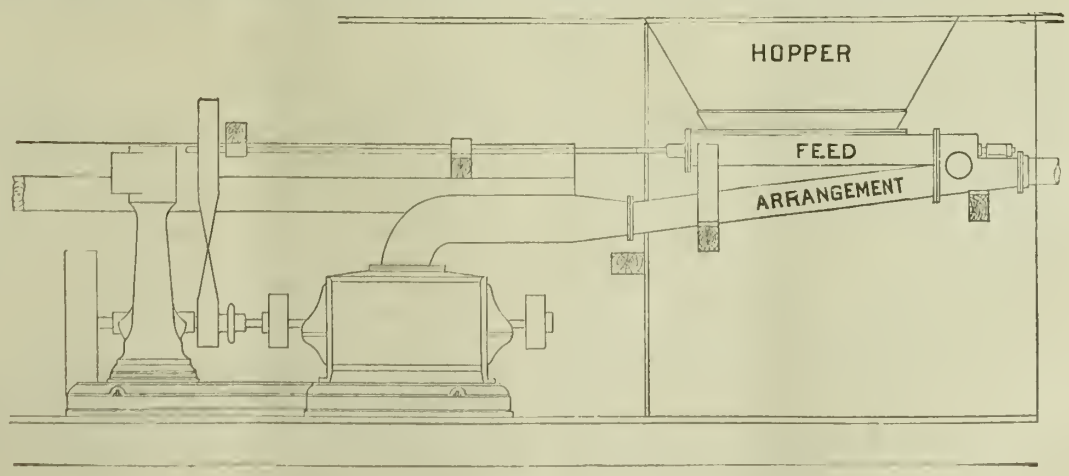
circumstances will permit, it can be governed by the man who dumps the coal into the elevator.

The Gallup (N. M.) Coal Co., say it "does the business," the feed worm only feeds just as much slack as the blast will take away, and it effects a saving of eight dollars per day over the old style.

The Consolidated Coal and Mining Co. (the plan of whose plant is shown herewith) also say that the Roots remover "gives perfect satisfaction," taking care of all their slack. And they would not be without it for anything.

The Morris Coal Co., of Jobs, O., give some interesting details, saying:

"We loaded yesterday in nine hours 2,156 tons of lump coal—your plant took care of all the slack we made. Had we been hauling as we used to do, it would have taken three horses and four men and I doubt if they could have kept it out of the way. The plant is a saving to us over the old way of handling it of eight dollars per day, besides giving us no trouble in waiting on the horses as formerly. Then with a limited space for slack, as we have here, it is just the thing—piles the slack much higher than we could have hauled it."



The Roots Slack Remover (Plan) at Brashears, O.

The American Engineer.

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Supreme Chief Engineer A. O. of S. E.

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CONTENTS OF THIS NUMBER.

INDIANA IN LINE.

Bro. Geo. W. Rose, Deputy Supreme Chief Engineer, Indiana, (South Dist.) has succeeded in organizing the first council in that state, at Evansville, with fourteen charter members. The list is as follows:

Geo. W. Rose,	Geo. D. Partington,
M. J. Browning,	Adam Kline,
Victor Harding,	Wm. P. Blanchet,
S. A. Williams,	F. W. Lickey,
L. W. McCrary,	S. F. Tucker,
V. B. Adams,	Carlos D. Wilson,
Robert L. Wiley,	Geo. Roeder.

All men of long experience. We congratulate Bro. Geo. W. Rose upon his good work for the Order, and wish this council every success. We hope to hear from it often, and take pleasure in wishing them great success. We publish below a report of the new council, as published in the Evansville *Journal* of Sunday morning, Oct. 18th.

SUSPENDED.

Frank Weidner of Welcome Council No. 2, Pennsylvania, was suspended for the term of five years from Sept. 25th, 1891, because of violation of his obligation and conduct unbecoming a brother and engineer.

(Signed)
JOS. L. HIGH, Cor. Engr., Welcome Council.
JAS. LIGHTFOOT, Gr. Cor. Engr., State of Pa.

SUPREME TRUSTEE APPOINTMENT.

PONTAIC BLD'G, CHICAGO, ILL., Oct. 20, 1891.
To the Officers and Members of the A. O. of S. E.

DEAR BROTHERS:—You are hereby notified that I have this day appointed Brother Frank S. Neal to be Supreme Trustee (term expiring 1895) in the place of Frank Weidner, who has been suspended from his Council. Yours fraternally,

JEFF. YOUNG, JR., Supreme Chief Engr.

SUPREME COUNCIL OFFICERS.

Photos of the officers of the Supreme Council taken at Syracuse, N. Y., July last, are ready; size 8x10, price 40 cents each.

MRS. FLORENCE E. MAYBRICK.

The Chicago *Graphic* publishes a portrait of Mrs. Maybrick who is now in an English prison, having barely escaped the gallows, on a conviction of having poisoned her husband. The evidence was inconclusive and there was room for grave doubt, to say the least; and just for that reason the insane, bulldozing Justice Sir James Fitzjames Stephen, who carries a number of initials of Indian "honors" after his name, was determined to secure a conviction. This mad judge is famous for going against the evidence simply to show what he can do. He bamboozled the jury to acquit a police superintendent in Warwickshire, some time ago, who was profiting by a gang of professional swindlers, with whom he was in league, although the evidence was "dead" against him. Thus when the evidence is strong his "lordship," who is an ardent admirer of Warren Hastings, makes it weak, and when the "proof" is weak he concocts ingredients to make it strong—to the jury. And English juries look upon their judges as pretty big gods, whom they "reverence" with awe, as a rule. An insane judge can sway the minds of such juries any way he pleases. Justice Stephen knows this as well as anybody, if he is insane—in fact his insanity consists in imagining himself "all-powerful" and thus he convicted Mrs. Maybrick. According to the *Graphic*, and other papers, Mrs. Maybrick's friends are endeavoring to obtain a new trial for her. This is merely waste of time and energies, for according to English law, which has become law by "rule of court," there can be no appeal nor a new trial in criminal cases over there. So, once convicted for a crime the conviction stands, like the laws of the Medes and Persians, unchangeable. The only way to obtain release from the sentence (or part of it) is by "pardon." And if Mrs. Maybrick's friends want to get her out of jail, they must "move heaven and earth" to get her pardoned. That may appear ridiculous when they believe she is innocent, but it is the law which they must deal with.

FARADAY'S DISCOVERY.

Around the magnet Faraday
Is sure that Volta's lightnings play;
But how to draw them from the wire!
He takes a lesson from the heart.
'Tis when we meet, 'tis when we part,
Breaks forth th' electric fire?

—*Clerk Maxwell.*

GRAHAM COUNCIL, FAIRBURY, ILL.

A telegram from Fairbury, Ill., says that Graham Council, No. 6, Illinois, was organized on Wednesday evening, with twelve charter members. Supreme Chief Engineer Jefferson Young, Jr., conducted the initiatory and installation proceedings.

WHAT CONSTITUTES A STATIONARY ENGINEER.

A correspondent in a recent number of the *Stationary Engineer* says: "In answer to the inquiry as to the definition of stationary engineer I would give this: 'Any person capable of erecting and running a stationary steam plant successfully and safely.' Some will take exceptions to this answer, and say it is too strict, claiming that there are many persons who can run a plant who are incapable of erecting it. Others will say it is too liberal, as it would include those handling plants in which there was no engine used.

"To the first I would say that I hold no man is an engineer who could not have put up the plant he runs. To the second I reply that there are numerous steam plants used for heating, pumping and other purposes, where no engine is used, which require the attention of persons equally qualified with those who have charge of plants using an engine, and who have an equal right to the title of stationary engineer.

"In a large Eastern city is a firm who make a business of manufacturing machinery for steam plants. In this same city there lived a young man whose ambition was to become an engineer. With that intention he entered those shops as an apprentice. Step by step he mastered each branch, including several months in the fireroom. After serving his time in the machine shop, he worked a year in the boiler department, in order to acquaint himself with boiler construction. Having a chance to take charge of a plant which he had helped to erect, he did so. Under his management everything was soon running smoothly and satisfactorily. He was justly proud of his plant, and took pride in showing it to visitors, together with his indicator cards and records of engine and boiler tests, and when Saturday night came he received his wages with a consciousness of having earned them.

"After having been there over three years, his employer, after paying him on Saturday night, told him that times being dull, they would be obliged to cut down expenses, and that his salary must be reduced. Feeling that he had been earning all that he had received, he refused to take the reduced wages, and picking up his tools left for good. Monday morning the fireman was in his place and a new man at the scoop. It was spring, and navigation on the great lakes just opening, he secured a position on a steamer, and continued to run until December found them icebound, and laid up for the winter at Chicago. He then went South and took a job in the great coal fields of Illinois, running an engine at a mine. Here he staid until the following summer, when, the miners going out on a strike, the works were shut down and he was again out of work.

"He then went to San Francisco, where his love for the water induced him to secure a position on a steamer running to different parts on the coast. This place he held for four years, until the vessel becoming unserviceable, the owners laid her up. A new railroad was being built, and he took a position as engineer on a construction train. The road being finished, he was offered a job in the shop, which he accepted. His abilities soon becoming known, he was given charge of the shops at a salary more liberal than he could receive as an engineer. This position he still holds.

"What would you call him? If you asked him he would reply proudly that he was an engineer, and I think he is right, and that he is no less an engineer to-day than he was when in charge of the first plant because he learned that as a trade, and because he is competent to perform all the duties of such a position. In contrast to this man, I will write of one whom I met several years ago. I stopped at a mill, one of the kind very common in the timbered portion of the Western and Southern States, a sawmill with a grist mill attachment, where they divided their time between sawing logs and grinding corn for the farmers of the surrounding country. In entering, the only person that I would have taken for the engineer was a boy of perhaps sixteen years, who was cutting slabs near the boiler. Asking him if he were the engineer, he said:

"'No, that was the engineer on that barrel near the saw.'

"Looking in the direction indicated I saw the

man busy mending a whip lash for a teamster who stood near, while the sawyer and men were engaged rolling a large white oak log on the carriage. While these preparations were going on, I took a look around the mill. The engine, a plain slide valve, was running slowly and was pounding in a way that would remind one of the Anvil Chorns on a small scale, and steam was whistling from around the well-fluted piston rod. The boiler, which was an ordinary two flue boiler, was in keeping with the condition of the engine. The front had a desire to part company with the rest of the boiler, but was prevented from doing so by two posts propped against it. Water was dripping from the gauge cocks and from under the soft patches on different parts of the boiler. The steam gauge was in such a condition that I conld see no figures on it. A place in the delivery pipe from the pump had evidently been cracked, and was repaired with a piece of leather bonnd on with rope, and every stroke of the pump served to increase the general dampness of the place.

"The engineer, having finished the whip, and the log being nearly set, came over to the engine, and while sqnirting oil over it, we engaged in a general conversation. Presently I remarked that he had been in charge there a long time. 'Yes,' said he, 'I have been here twelve years, and I know every joint in this machine (I did not doubt that, for every joint was speaking for itself.) Yes, sir, for twelve years I have stood at that throttle. In fact, I have worn outthree throttles on her, so you can jndge how mnch I have pnlled it. Turning to the boy he said: "Whoop her up, Jim, they have got an old butt ent on there and we'll need more gas."

"'How mnch steam do yon usually carry?" asked.

"Well, about eighty pounds. I don't know exactly, for the gange ain't as good as it used to be. We had a little fire here two years ago that burned it some, so yon can't see the figures, but I put that big black mark on it where the eighty was, and I tell Jim to keep her up to that.

"'Don't yon fear that she will let go some time?' I asked.

"'Oh, no, a boiler can't bnst if you keep plenty of water in it, and I always see that Jim keeps two gauges in her.'

"'Well, I suppose living out here, where you see so few people, you must read a good deal; do you take any mechanical or engineer papers?'

"'No, sir, no. I got no use for book learning. I believe in learning everything by experience. Experience is the best teacher in the world, sir. That is where I got mine, and I don't take a back seat for any of 'em. Book learning is for them soft fingered kind that's got gall enongh to make some city man thinks he needs a fine-haired man to stand in his high-toned engine room and do nothing bnt boss the men that do the dirty work. No, sir, I don't want no books in mine.'

"'The sawyer now gives the signal for more speed, and telling Jim again to 'Whoop her up!' he pulls the throttle with a jerk, and the engine, giving a lond groan at such treatment, gets away at a speed that sends the saw flying into the log, and the bystanders looking admirably on exclaim: 'My, don't she hum!'

"When the cut is finished with steam cut down at least thirty pounds, and the speed of the enginc to less than half of the starting speed, the engineer tnrns to me and says: 'That's the way we do it here. Yon can't learn that out of books, now, can you?' I sorrowfully answer no, and bidding him good-by I tnrn to pnrsue my benighted way. People there speak of him admiringly as the engineer. By courtesy we also call him the engineer. Stationary he is as regards the years in which he has stood by this his only engine, and stationary he is and always will be in his ideas. Is he an engineer or not? Echo answers, Not."

The British admiralty claims to have produced in the new war ship Blake the largest, swiftest and most powerful crniser in the world. She has cost $2,500,000, and if official hopes be confirmed she will be cheap at the price. She is guaranteed to steam twenty-two knots an hour. Her boilers will develope 20,000 horse-power, and she has phenomenal coal-carrying capacity.

OUR FRIENDS.

3.—W. V. WARFIELD.

We here give drawing of our friend, W. V. Warfield, Supreme Corresponding Engineer, A. O. of S. E. This is not a perfect likeness of the gentleman, but it is the best we could do, from memory, and will be readily recognized by his many friends. We wrote to Bro. Warfield, asking that he would furnish us with his photo and a short sketch of his life, but Billy is not to be caught that way. He answered politely by saying, "You don't get my phiz, see?" So we had to get out our think-tank, touch the button, and the rest is here presented.

Brother Warfield, or Billy, as he is more familiarly known, was born somewhere in Massachusetts. We cannot state just where, but we do know that he went to the front as a soldier, fought during the entire war, as a member of one of the brave Massachusetts regiments, and received a terrible wound, from which he is still suffering and for which he receives a liberal pension. Brother Warfield has been an active member of the American Order of Steam Engineers since Bay State Council joined that Order in a body in the spring of '88. He held the office of Supreme Corresponding Engineer for two terms, but was determined to refuse re-election at the Supreme Conncil held in Philadelphia in 1890, his reason for refusing renomination being that he had taken charge of the Board of Trade Building in

W. V. Warfield.

the city of Boston, and that being in the course of erection, with everything to be straightened out, he could not devote the time to official duties of the Order.

Bro. Warfield was greatly missed at the Supreme Council held last July in Syracuse. Last August, upon the resignation of Brother Neal from the office of Supreme Corresponding Engineer, Brother Warfield was urged to accept the position again. His answer came back: "I will do anything to help the American Order of Steam Engineers; put me down for that."

Brother Warfield also holds the position of Grand Chief Engineer, State of Massachusetts. He is very popular with all the boys, is a thorough engineer and a perfect gentleman. We regret that his bashfulness has prevented us from securing a much better likeness.

Bids for the construction of the Government's Exposition building have been opened in Washington for the second time. It was found that there were twenty-six bidders altogether. Contracts for the construction of the building have been let to four firms—three in Chicago and one in Indianapolis—for different parts of the work. The aggregate amount of these contracts is $316,757, which is less by $22,000 than any single bid for the entire work. The first batch of blds was rejected because none of them was within the available appropriation of $400,000. Slight modifications in the plans were made and bids again called for with the above result. The erection of the building will begin at once.

The general passenger agents of twenty of the railroads entering Chicago have organized a special association for the determination of excursion rates to the Exposition and for arranging facilities for caring for the enormous crowds of visitors to the World's Fair.

LOCALIZATION AND REMEDY OF TROUBLES IN DYNAMOS OR MOTORS.—IV.

By Prof. Francis B. Crocker and Dr. S. S. Wheeler.

Continued from page 153.

V.—NOISE.

1st Cause.—*Vibration due to armature or pulley being out of balance.*

Symptom.—Strong vibration felt when hand is placed on machine while running. Vibration changes greatly if speed is changed, and sometimes almost disappears at certain speeds.

REMEDY.—Armature or pulley must be perfectly balanced by securely attaching lead or other weight on light side, which can be found by trial. The easiest method of finding in which direction the armature is out of balance is to take it out and rest the shaft on two parallel and horizontal A-shaped metallic tracks sufficiently far apart to allow armature to go between them. If the armature is then slowly rolled back and forth, the heavy side will, of course, tend to turn downwards. The armature and pulley should always be balanced separately. An excess of weight on one side of pulley and an equal excess of weight on opposite side of armature will not produce a balance while running, though it may appear to when standing still; on the contrary, it will give the shaft a strong tendency to "wobble."

2nd Cause.—*Armature striking pole-pieces.*

Symptom.—Easily detected by placing the ear near the pole-pieces or by examining armature to see if its surface is abraded at any point, or by examining each part of the space between armature and field, as armature is slowly revolved, to see it at any point it touches or is so close as to be likely to touch when the machine is running. It is unwise to have a clearance of less than one-sixteenth inch full. Also turn armature by hand when no current is on and note if it sticks at any point.

REMEDY.—Bind down any wire or other part of armature that may project abnormally, or file out pole-pieces where armature strikes.

3rd Cause.—*Shaft collars, shoulders, hub or edges of pulley or belt rattling against bearings.*

Symptom.—Noise stops when shaft is pushed lengthwise away from one or the other of the bearings. (See Heating of the Bearings, No. 7.)

REMEDY.—Shift collar or pulley, turn off shoulder on shaft, file or turn off the bearing, move pulley on shaft or straighten belt until they do not touch and noise ceases.

4th Cause.—*Rattling due to looseness of screws or other parts.*

Symptom.—Close examination of the bearings, shaft, pulley, screws, nuts, binding posts, &c., or touching the machine while running, or shaking its parts while standing still, will usually show the particular parts which are loose.

REMEDY.—Tighten up the loose parts, and be careful to keep them all in place and properly set up. It is very easy to guard against the occurrence of this trouble, which is very common, by simply examining the various screws and other parts each day before the machine is started.

5th Cause.—*Singing or hissing of brushes on commutator,* usually occasioned by rough or eccentric commutator (See Sparking at Commutator, No. 3), or by tips of brushes not being smooth, or the layers of a copper brush not being held together and in place; with carbon brushes, hissing will be caused by the use of carbon which is gritty or too hard. Vertical carbon brushes or inclined brushes running backward are apt to squeak or sing.

Symptom.—Sound of high pitch and easily located by putting the ear near the commutator while it is running, and by lifting off the brushes one at a time.

REMEDY.—Apply a very little oil to the commutator with the finger or a rag. Adjust brushes or smooth commutator by turning, filing or fine sand-

paper. Carbon brushes are apt to squeak in starting up or at slow speed. This decreases at full speed, and can usually be reduced by moistening carbon brush with oil, care being taken not to have any drops or excess of oil.

6th Cause.—*Flapping or pounding of belt joint or lacing against pulley.*

Symptom.—Sound repeated once for each complete revolution of the belt, which is much less frequent than any other dynamo or motor sound, and can be heard and easily counted.

REMEDY.—Endless belt or smoother joint in belt. A perfect joint and a straight, smooth belt are always very desirable for dynamos and motors.

7th Cause.—*Slipping of belt or pulley due to overload.*

Symptom.—Intermittent squeaking noise.

REMEDY.—Tighten the belt, or reduce the load. A wider belt may be required.

8th Cause.—*Humming of armature core teeth (if any) as they pass pole-pieces.*

Symptom.—Pure humming sound less metallic than No. 5.

REMEDY.—Slope ends of pole-pieces so that armature tooth does not pass edge of pole-piece all at once. Decrease the magnetization of the fields. Increase the cross section or capacity of the teeth, or reduce that of the body of the armature.

LIFE ON A GREAT SHIP.

An article of great interest, as well as of considerable length, recently appeared in the New York *Sun* containing "unembellished facts from the various departments of an Atlantic liner," and giving "details to astonish those who think that an ocean steamer runs itself."

What is of special interest to the readers of The American Engineer is the description of the engine department and its operations: That we here give in full, but the rest is well worth summarizing. The City of Paris is the great Atlantic liner portrayed.

On every ship there are three departments—the sailing, or deck department, the passenger, or steward's department, and the engine department. Each of these departments has a crew of its own, under the personal supervision of a chief officer. Supreme over the combination of all the departments is the captain, who is an absolute monarch during the time that his ship is at sea. On the City of Paris there are eight officers besides the captain. Everyone of them holds a master's certificate issued by the Board of Trade of Liverpool, so that there are nine men on the ship who are competent to take her in charge. The City of Paris was advertised to sail from Liverpool on her latest voyage at 5 o'clock on the afternoon of Septemper 2. The first tender for passengers left Prince's landing stage at 3:30 o'colck, and the last one at 5 o'clock. With each tender was a lighter carrying passengers' baggage- The ship lay in the river ready to sail, waiting only for the tide. Down in the stoke holes the coal trimmers were waiting to begin their seven-day-run between the coal bunkers and the furnaces. Steam was up, and in the engine-room the engineer on watch stood by waiting to receive the signal from the bridge, where already the watch was set.

It was 7 o'clock when the tide suited, and Captain Watkin's order to start the engines was telegraphed from the bridge to the engine-room. So quiet was the start that the people at dinner could not determine whether the ship was moving or not without watching the lights on shore.

The routine of the voyage was begun. The engine department betook itself to the driving of the ship over 3,200 miles of ocean. The sailing department prepared to see that the ship came to New York instead of to grief. The passenger department was already devoting itself to the comfort of the 1,132 passengers.

The sailing department musters 59 men and boys; the passenger department 158 men, boys and women; and the engine department 198 men—in all 415. The 59 men of the sailing department are 9 officers. 28 able seamen, 2 ordinary seamen, 12 quartermasters, a bo's'n and mate, carpenter and mate, and 4 masters-at arms.

The carpenter is a most important individual. He has served his time as a carpenter in a shipbuilding yard, and has to keep all the carpenter work on the ship in good order. He has charge of all the pumps outside the engine room, steam pumps, the windlass, anchors, and anchor gear, doors, hatches, and such things. In case of accident he is the man who makes the examination of the ship and has the biggest part of the repairing to do. He has one mate to assist him.

THE ENGINE DEPARTMENT.

There is a notion going about that the records of ocean greyhounds are broken somewhere up on the bridge, and the man who is generally credited with doing the record smashing is the captain. It is certain that some captains are as much pulled up by such an achievement on the part of their ships as if the new record was the result of their personal efforts. But if you want to see where records are really made you should visit the engine room. The greasy fellows who stand around as if they had nothing whatever to interest them in life, but are really watching every little bit of machinery to see that it does its work; the good natured but oily chief engineer, who knows every part of his engine so well that he can tell where he is by the noise, and those grimy, sooty, white-eyed chaps puffing along under big baskets of coal, or jamming long iron rods into furnaces that roar white hot—these are the men who know and can tell where speed is born and where records grow. It is small exaggeration to say that they can tell you in yards the distance the ship will make any given minute, and they know to a nicety which is startling the effect in feet and inches which revolutions of the screws have upon the speed of the ship. More than that, they know how to make the screws revolve with wonderful rapidity, and they understand the trick of keeping at it from the minute they begin until the voyage is finished.

In the engine department of the City of Paris there are 198 men. The ruler of the department is the chief engineer, and he has eighteen other engineers to assist him. Then there are twenty-four greasers, nine water tenders, seventy-two firemen, fifty-four trimmers, three boss trimmers, three donkey men, three cooks, three electricians, three store-keepers, two hydrant engineers, and two refrigerator experts, commonly called beef stiffeners, and one clerk of the chief engineer. Of the eighteen engineers, other than the chief, three rank as second, six as third, six as fourth, and three as fifth engineers.

All watches in the engine department are four hours long, and there are no dog watches. The men stand four hours and are off eight hours, so that they stand the same watches every day. There is always a second engineer in charge of the engines. With him are one third, one fourth, and one fifth engineer. One third and fourth engineer are always on watch at the stockholes.

The City of Paris has nine boilers arranged in groups of three, in separate divisions of the ship. In charge of each group of boilers during a watch is one water tender, who is under the supervison of the second engineer on watch. Eight stokers and six coal trimmers tend the fires in each set of boilers during a watch, and eight greasers are constantly employed oiling the big engines. One boss trimmer is on duty during each watch.

The stokers are the firemen. The coal trimmers bring them the coal from the bunkers. Their work is hard and hot and fast, but there are a great many very much mistaken notions about the tremendous hardships endured by the stokers of big steamships. The stokers on the City of Paris work for four hours at a stretch, and are off duty for eight hours. They work in a temperature of about 100°, but there is a constant draught through the stokeholes and coal bunkers, and not a mild draught either, but a good, strong, healthy breeze of cool, fresh air forced down by the giant fans in the ventilators on the main deck. As a rule they are men who earn more money and have a better time of life, as they regard it, in their business than at any other work which they can do. They earn their money by two weeks' work, and with it comes support and idleness for two other weeks. The Board of Trade of Liverpool has made a scale by which all the ship's crew shall be fed, and the day before the ship goes to sea a surveyor comes on board and goes through ship's stores to see that they comply with the law.

A visit to the engine-room of the City of Paris is by no means as unpleasant as some people affect to believe. Just as in the stokeholes, there is a constant, sturdy breeze of fresh, cool air, so that the temperature is much more endurable than that of many of New York's summer days. The great engines work with remarkaby little noise, and it is reassuring to those nervous ones who always have more or less dread of accident to see the way the watch is kept. The eight greasers are constantly making their rounds, wiping a rod here, dropping a little oil there, and telling by simply feeling of the swiftly moving machinery whether it is working well or not. At the big row of steam gauges, and other indicators, where the telegraph dials that connect with the bridge are, an engineer is always standing, ready to answer the least signal.

One of the most interesting devices in the engine room is about the simplest. It is the arrangement by which the engineers tell whether that part of the shaft which extends outside the ship's hold is working smoothly or not. In all twin-screw ships this runs through a sort of tunnel fastened to the ship by big brackets. Of course, it is impossible to get at this part of the shaft during a voyage. On the City of Paris this is forty feet long. The engineers have rigged a little, fine tube along the top of the shaft which runs inside the ship, just over the shaft. Water is constantly running through this tube in a fine stream. The engineer on watch frequently tries the temperature of this water with his hand. If the water were warm he would know at once that something was wrong with the working of the shaft, and it would be slowed down. If that did not remedy the trouble the engines on that side would be stopped. This device is as perfect in its working as it is simple in its construction.

In foggy weather the "stand by" watch is called on. These are the men whose turn it is to go on duty at the next watch. They come to their places in the engine room and "stand by," doing nothing, but ready at any instant to take hold, acting simply as an emergency precaution. The signals to the engine room from the bridge are telegraphed on a dial. There is an exactly similar dial on the bridge. To whatever signal the hand on the bridge dial points the dial in the engine-room also points.

Between the starboard and port engine spaces is a little narrow room, presided over by the storekeepers. In it can be found anything that could ever be needed for repairs to any part of the machinery—bolts, nuts, screws, rivets, wire, steel, iron, anything and everything you can think of pertaining to that business. There is a little lathe and all sorts of drills, and the whole is a wonderfully complete little machine shop. These storekeepers also have charge of the oil and waste used about the engines and of the spare gear.

The two hydraulic engineers stand six hour watches, watch and watch. They have charge of the hydraulic engines which run the steering gear, man lifts, of which there are a lot in the ship, derricks, capstans, and refrigerating apparatus. The three electricians have charge of the dynamos and the lighting and ventilation of the ship.

There is one man on board the City of Paris for whom life must be one long nightmare. He is the chief steward, who, under the general supervision of the purser, has charge of the entire passenger department. He has work to do which makes men gray-haired while they are yet young, and stoop-shouldered before they have reached middle age. Everything that everybody wants to know or do or see, he asks the chief steward about.

There are nineteen cooks and assistants including scullery boys and vegetable men. The chief himself prepares all soups and entrees, and the second cook prepares the joints and fish. The third cook assists the chief. The chief cook of the City of Paris is a big, good-natured Irishman. His pots and pans shine like his own face, and the boards and benches are as clean and white as the bread board in your mother's kitchen used to be.

On the last trip to New York there were prepared for the use of the passengers 18,000 pounds of beef, 5,000 pounds of mutton and lamb, 1,600 pounds of

veal, pork, and corned beef; 8,000 pounds of sausage, tripe, liver, calves' heads, calves' feet, sweetbreads, and kidneys, 2,000 pounds of fresh fish, 8,000 New York clams, 12,000 frying osters, 250 tins of jam and marmalade, 100 bottles of pickles and sauces, 500 pounds of coffee, 250 pounds of tea, 250 pounds of potted fish, pilchards, sardines, salmon, and lobsters; 300 fresh lobsters, 3,000 pounds of moist sugar, 600 pounds of lump sugar, 20 gallons of syrup, 800 gallons of milk, 24 gallons of cream, 500 quarts of ice cream, 500 pounds of fresh butter, 700 pounds of corned butter, and 2,000 pounds of salt butter; 16 tons of potatoes, 5 tons of cabbages, carrots, turnips, parsnips, and so on; 15,000 eggs, 3 barrels of corned pork, 1,000 chickens and ducks, 100 turkeys and geese, 2,000 grouse, partridge, quail, and reed birds, and 100 rabbits. That was part of what 536 saloon passengers ate in their seven days on the ship.

There are four other men in the ship's crew whose work has not yet been told about, besides the seven stewardesses, whose work is practically the same as that of the bedroom stewards, except that they are not required to stand watch. These four are the purser, the doctor, the barber, and the printer. The barber barbers, and does it well, very much as he would on land, and he has remarkably little to say. The printer prints the bills of fare and little notices, and once on each voyage he got out the *City of Paris Gazette*, for which the passengers contribute, and they pay sixpence or a shilling, as it happens.

The doctor always has plenty to do. One doctor in a town of a thousand people is sure to be busy enough; and then, in addition to all his calls, the doctor has his regular inspections of the ship to make. You can always tell the doctor by his uniform. He wears one gold stripe on his coat sleeve on a red velvet band.

The purser is one of the most important officers on the ship, and he has all sorts of things to do. He is in charge of the passenger department and all stores, and signs all requisitions with the chief steward. He is the financial agent of the owners aboard ship.

HOW IT IS DONE.

In Hine & Robertson's straight line indicator the parallel motion is accomplished by two rocking surfaces, one attached to an upright, and the other permanently fixed on the pencil arm. The one on the upright is made circular, and the other of such form that when the lever rises and falls, these two guiding surfaces roll together for a very slight distance and cause the pencil to move in a perfectly straight line throughout its full range. All that is required of the auxiliary spring is to give it sufficient tension to keep these guiding surfaces in contact while the instrument is running. This may be determined by turning on steam while the drum is stationary and noting if the pencil traverses the same vertical line. This spring is intended also to take up all play that may ever appear in the joints and oblige the pencil to always follow in the same path.

STRONG TESTIMONIAL.

In addition to testimonials which we have already published, the Consolidated Coal and Mining Co. say (in a letter to the P. H. & F. M. Roots Co.):

"It fills a 'long felt want,' being just the proper thing. The difference in the cost to us between handling our slack with your remover and the old way, viz: with slack cars and horses, is from five to seven dollars for every day we run our works, in favor of your apparatus. We are very much pleased with the results from this plant and would not be without it."

The savants and historians of Italy are now deeply interesting themselves in the question of Columbus' real birthplace. Five or six places besides Genoa claim the honor, and among them is Bettola. It is reported that proofs have lately been discovered establishing Bettola's claim, and that the town will erect a monument to Columbus at once and intends to send an envoy to the World's Fair with these proofs and other historical documents of interest.

CORRESPONDENCE.

Reliable Testing Machines.

Editor, American Engineer:

We have just completed, and have at our factory for exhibition for a few days, in operation, a large vertical screw power testing machine arranged with two movable cross-heads for quick adjustment for testing long and short specimens by tensile strength.

It will test by tensile strains, specimens from 10 ft down to 6 in. long; transverse specimens from 18 ft. to 1 ft.; compression specimens from 12 ft. down.

The machine is designed especially at our works, and built for the School of Practical Science, Toronto, Canada. Should you, or any of your readers, like to see this machine, would be glad to have you call at our works, 9th and Master Sts. Ask for Mr. C. E. Buzby, Snperintendent.

Yours truly,

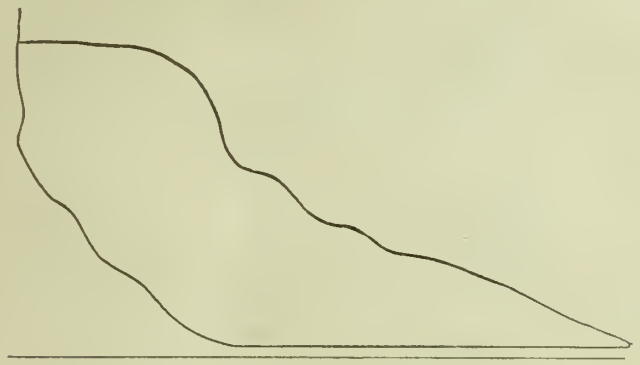
Riehle Bros. Testing Machine Co.

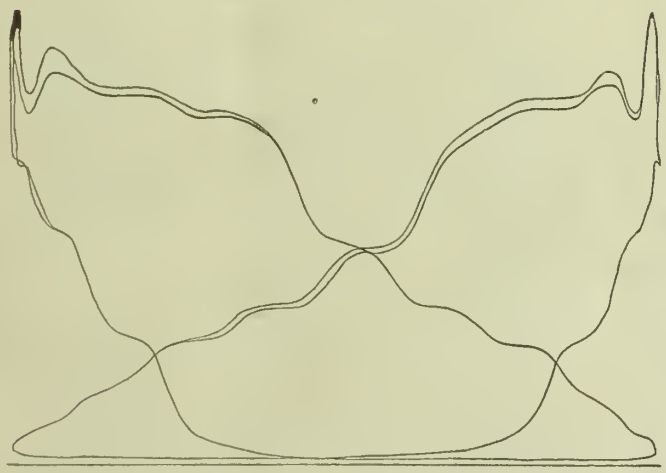
Who Can Expound These Cards?

Editor, American Engineer:

I have an Armington & Sims engine. These cards I took a few days ago.

What is the matter?





Will some engineer kindly enlighten me?
I have tried everything to fix up the engine.

Sub.

Where is It?

Editor, American Engineer:

Five dollars reward will be paid for the discovery of any information that will lead to the discovery of a new branch of the N. A. S. E., said to be located in Buffalo, N. Y. The last it was heard from Mr. Nick Kelley had it in his mouth, taking it to Omaha and from the best information obtainable, he blew it into the (Soup) Convention with a lot of other funny fables that he is noted for telling. I hear that Mr. Kelley said a great many things in a "bragging way," to make the assembled Convention feel good at Omaha; but he cannot be blamed, because he "kissed the blarney stone" sometime ago and it has been in his system ever since.

O. Maha.

Calculating Water in Cylinder.

Editor, American Engineer:

In reply to inquiry, would say that a simple rule for calculating the number of United States gallons contained in any cylinder one foot long is (1) to double the diameter and (2) then square the double, then (3) point off the two right hand figures; that is, the result is so many hundredths. Here is an example for a 10 inch pipe: $10\times2=20$; $20\times20=400$; and 400 hundredths=4.00; that is, there are four gallons in a cylinder 1′ long and 10″ diameter. This rule is near enough for all practical purposess, being only .02 less than the actual measurement, and the engineers will find it a great short cut when doing this kind of work.

Jerry Leahey, Jr.

"Man's Inhumanity to Man."

Editor, American Engineer:

I have either read or heard it said, that the cause of all our trouble (and principally our labor trouble) is "man's inhumanity to man." I think of this often and when I hear of the Supreme Conncil of the A. O. of S. E. passing resolutions that will be a great benefit to our Order and to every member thereof, not meeting with the approval of every member of subordinate councils; and when I hear how these resolutions, which are for the great good of the Order, are being attacked with monkey wrenches, hammers, chisels, oil cans, starting bars, anything and everything to defeat the purpose of the resolution—do you ask me why? Well, in plain English, I answer, because they think some one other than themselves is going to make some boodle. This is my opinion and in connection with this I would tell you a little story.

In the winter of '69 there were a number of stone cutters working on the Detroit city hall (it was in course of erection) and one among them, whom we will call Sandy, suggested that a lot of them go in together and buy a carload of hard coal right from the mine. They could get it here and have it delivered for about $2 per ton, whereas it would cost, at the local coal dealer's, $4 per ton. A good idea, Sandy, we will all go in. So Sandy took the names of about twenty-five, who all wanted from three to five tons each. This was about the middle of the month. They all got their pay on the 10th of the month. Now, between the time the names were taken and pay-day, Tom goes up to Jack and says: "Jack, what do you think about Sandy's coal scheme?" "I don't know" says Jack, "what do you think of it, Tom?" "Well, I think he is schemiug to get his own coal for nothing and make some money besides. You know he is a sharp one, that same Sandy." "I begin to thiuk he is, Tom, but if that is his dodge he will get noue of my money." Good-bye, coal. I would sooner go aud pay $4 a ton at the coal yards here than let him get any bulge on me. I am too smart for that, you know; I don't see why I didn't think of that before."

This flame, once started, grew rapidly all unbeknown to Sandy, who, when the 10th came, started around to collect; but out of about twenty-five names, only five had the courage to trust Sandy with a few dollars. Each one had some excuse; one had a sick wife; another had some relatives visiting him; another expected to go away; and you would be surprised at the paltry excuses they offered, instead of saying out, like men, "I cannot trust you, Sandy." But it was uot long until Sandy heard the whole story, and then some said they were sorry; some said they were fools; but they all had to pay $4 per ton for coal that winter.

Here I fancy, it looks a little like "man's inhumanity to man. and so I thought it was when certain members of the A. O. of S. E. tried to sit down on resolutions passed for their benefit.

Not wishing to take up auy more of your valuable space, if this gets in, I am,

Respectfully, Tom Kit.

P. S.—I am, by-the-bye, very glad to see men like Robt Forsyth, Jefferson Young, Jr., and others, all good and true men, at the throttle valve and stokehole of The American Engineer.

The Hidalgo and Northwestern Railroad Company, which is the principal transportation agency in northern and northwestern Mexico, has notified the Exposition officials that it will make no freight charges on articles sent to the Exposition at Chicago.

THE WOMEN'S DEPARTMENT.

ILLINOIS WOMEN'S EXPOSITION BOARD.

Office of the Illinois Women' Exposition Board.

CHICAGO, October 19, 1891.

Editress The American Engineer:

Will you be so kind as to insert in your paper the following brief address which will explain itself, and mail to the secretary a copy containing it:

FRANCIS B. PHILLIPS, Pres.
MARY CALLAHAN, Sec'y.

The Illinois Woman's Exposition Board is charged with the duty of preparing for the World's Columbian Exposition an exhibit representing the industries of the women of this State. In order to set about this work intelligently and presecute it thoroughly the Board needs the fullest possible information in regard to the part now being taken by women in the industries of Illinois. Every woman in the State who is engaged in any profession, craft, or other industry, is earnestly requested to send her name, address and occupation to this Board. With this data the Board would be best able to plan the exhibit and reach the possible exhibitors.

ENCOURAGEMENT FOR WOMEN WORKERS.

Twenty-eight States were represented at Thursday's sessions of the National Woman's Congress, at Grand Rapids, Mich., last week. Mrs. H. T. L. Wolcott, President of the Committee on Science, reported that during the year unusual progress had been made by women in medicine, surgery, the law, higher mathematics, and astronomy. In the afternoon Mrs. Maude Howe Elliot presented a paper on "Some American Artists." Mrs. Ellen H. Dedriech discussed "Women in Africa," and the session ended with a medical symposium on la grippe, led by Dr. Mark, of Baltimore. In the evening Mrs. Julia Ward Howe addressed the congress on "Aliens in America," and Mrs. Colby recited "The Results of Woman Suffrage in Wyoming."

IN MEMORIAM.

BY ELIZA ALLISON PARK.

A hand upon the throttle and an eye upon the road
Where the dire disaster waited, while their young hearts throbbed and glowed
With the music and the mystery of all life's gladdest things.
Little thinking of the nearness of a "harp" with golden strings.
A rush—a crash—then silence, for death had 'gulfed them all,
Had clasped them close and held them in his dreadful, awful pall.
We stand with heads uncovered, reverently beside our dead,
Grief measures all our depth, alas! in their silent, narrow bed.

GOING TO HOUSEKEEPING.

To some the beginning of their housekeeping is the beginning of an era of delight and ever-increasing happiness. To others it is the beginning of an era of pain, vexation and disappointment. Everything depends on the preparation that precedes it says the *Christian at Work*. The young woman who has been made familiar with the various duties and demands made upon the housewife, who has been in the habit of taking the care from her mother's shoulders or sharing the burden of it, will enjoy having a house and home of her own, and managing it in all its details. Recalling her mother's methods, she will gradually perfect her own and adapt them to the exigencies of her situation.

The young woman without this preparation will find herself plunged into a sea of troubles. If she has servants her trouble will be increased rather than diminished, for she is not only at the mercy of her own ignorance and incapacity, but also at the mercy of her servants, who will be very far above the average if they do not take advantage of her deficiencies to slight their work and waste as much as they earn. Then, again, a home that is in fact presided over by the servants is a very unsatisfactory place, as much so to its nominal mistress as to its masculine head.

The sufferings women untaught in domestic affairs often undergo in making expert housekeepers are very great. The routine that must be observed, the drudgery that must be done, the habits that must be broken, and the habits that must be formed—these make life a burden, and for the time dim affection and hope. The romance of married life dies out under the monotony of three meals a day with the inevitable dish-washing accompanying them, of perpetual sweeping and cleaning and renewing; but when the burden is taken up and borne with cheerfulness and positive gladness, then it ceases to be a burden, and love makes it light.

It can not be that mothers who require no help from their daughters in household matters, and who permit them to grow up in ignorance of the methods and processes every housekeeper should be practically familiar with, are doing their duty. They owe it to themselves, to their daughters, to the men who are to be the husbands of their daughters and to their grandchildren, to see to it that domestic training in their families is thorough and practical.

A DECIDED INCREASE IN THE NUMBER OF PRETTY WOMEN.

"Yes, she's decidedly pretty; but not half so pretty as her mother was at her age!" How often do we bear this remark when we venture to praise some beauty of the present day in the hearing of any one of an older generation. It suggests an important question—whether the standard of beauty is changing; and, if so, whether women are more or less beautiful than they used to be. This is a question which may, happily, be answered to the entire satisfaction of the present generation. There can be no reasonable doubt that there is greater beauty now and more of it than at any previous time.

No woman has been more celebrated for her beauty than Mary, Queen of Scots; but if she were to walk unannounced into a London drawing-room to-day it is doubtful if she would cause much remark. No doubt she would still retain the power of captivating people with her charms, but she would no longer bewitch them by her face. It is true we can hardly realize what Mary was like; we are not even sure of the color of her hair or her eyes. The various authentic portraits of her are strangely dissimilar. They only agree in this: That they all show us a face which disappoints us.

As we are not satisfied with a degree of beauty which was enough for Mary's contemporaries—which sent the men of her day off their heads and filled her cousin, Elizabeth, with deadly jealousy—the inference is that the standard of beauty has risen; and the rise has probably been gradual and constant, each generation making a certain advance on its predecessor. One can hardly resist a conclusion of this kind after looking over a collection of portraits of a single family for three or four centuries, such as one may see in any large, old country house. The further back we go the plainer the ancestors become; and if we begin with the earliest and trace them down to the present time we find them steadily improving as we advance.

It may be said that this is the fault of the old painters, who did not know how to make good likenesses. But no one has ever looked at Holbein's portraits of Henry VIII, full of life and character as they are, without feeling that the real Henry stands before him. And if Holbein can give us such a lifelike representation of Henry, can he be incompetent to give us an idea of Anne Boleyn? Yet the beauty of Anne Boleyn, as Holbein represents it—the fatal beauty which lured Henry from his allegiance to Catherine—is certainly not what we should rave about now.

There is considerable advance in general beauty when we pass on to the portraits of the next century. The ladies of the reign of Charles I., as painted by Vandyck, are about the first who are really pretty according to our ideas, though the delicate flattery of the artist in trying to give them all a resemblance to Henrietta Maria makes them look a little monotonous. One cannot help wondering, by the way, what has become of the wonderful pearls which, from the Queen downward, they were all in the habit of wearing around their necks and in their ears.

Judging from their portraits the ladies of the Restoration period must have been at least as pretty as their mothers, with more variety about their style; the points in which they most resemble each other being a softness and sensuousness, due to a not unnatural rebound when the strain of Puritan primness was suddenly removed.

One's first impression on visiting a collection of Reynoldses and Gainesboroughs is that all the women of that time must have been lovely and the painters lucky to get such subjects. One's second impression, however, is apt to be that the sisters were lucky to have such painters, for the real attraction is more often in the pictures than in the faces. Not that there are not plenty of beautiful faces among them, but that beauty is by no means universal, and, further, that there is no beauty on the canvasses of last century which could not be easily matched to-day.

As to beauty in the present day, it is quite unnecessary to speak. No one who keeps his eyes open can fail to be struck by it. It is not merely that there are more beauties of the first order than there seem ever to have been before, but that beauty has become so general. Any one who wishes to test this has only to take his stand and watch the stream of life rolling past him in carriages and on foot; and if he does not see in one afternoon more pretty faces than in all the Reynoldses and Gainsboroughs he knows, he will be unfortunate. Indeed, it is hardly possible to deny that in this matter of beauty at least our age has gone a good deal ahead of its predecessors.—*Cincinnati Commercial Gazette.*

THE REAL SECRET OF YOUTH.

As an explanation why certain women "continue to be fresh and beautiful," a respectable contemporary says:—

People are apt to attribute haggard looks to mental activity, and to counsel repose and tranquility as a cosmetic.

To the thoughtful traveler, the falsity of this theory is obvious. It is in the country village, where the church meeting is the theatre, the mail the excitement, the days weeks, and one can hear the cows breathe in the deathly stillness that the greatest number of sunken cheeks, wrinkled brows, leaden complexions, and lifeless expressions are to be seen among the women yet in their thirties. In the seething metropolis, living three lives and enjoying two, are to be found scores of women—mothers or perhaps grandmother—possessing all the vitality, freshness, and much of the bloom of early youth.

The fact is, says a writer in the New York *World*, it is not activity, but drowsiness, the presence of sleeping or dead thought in the soul that is aging. Unvaried scenes, the repetition to-morrow of to-day, to-day of yesterday, this week of the preceding one, the ability to calculate exactly what each neighbor is doing at each hour of the day—the inevitable clock-like routine of conception, the monotony of existence, the utter weariness of an empty think-tank, that saps the vernal springs of life and creates decay in the face.

Past grief, old angers, revenges, even past pleasures constantly dwelt upon—all dead, decaying, or decayed thought—make a sepulcher of the soul, a cemetery of the body, and a weather-beaten monument of the face. This is age.

The women who never grow old are the student women—those who daily drink in new chyle through memorizing, thoroughly analyzing, and perfectly assimilating subjects apart from themselves. Study is development—is eternal youth. The student woman who makes wise use of her acquisitions has no time to corrugate her brow with dread thought of the beauty-destroyer leaping fast behind her. Not considered nor invited, Old Age keeps his distance.

Brain culture, based on noble motive, means sympathy, heart gentleness, charity, graciousness, enlargement of sense, feeling, power.

Such a being cannot become a fossil. She has found the elixir of life, the fountain of eternal youth.

PRESERVING THE COMPLEXION

A great deal can be done towards having a fine and smooth complexion, by a systematic treatment of rubbing, says *The Ladies' Home Journal*. A fine towel or a bit of red flannel are best for rubbing, twice a day, or four times, if rapid results are to accrue By degrees—as the skin gains tone and elasticity from having thrown off the waste matter in its ducts that kept it clogged, sickly and flabby—the friction can increase in energy. The skin becomes, not tougher, but more resistant. If the rubbing is too hard at first, however, it is liable to produce redness and pimples. Even slight friction will do this at times on an unaccustomed skin. But the treatment should be persevered in nevertheless, and the skin soon becomes extraordinarily fine and smooth.

WOMEN ENGINEERS.

Beside those already mentioned in our previous issues, the New York *Sun* states that there are two expert and popular women mechanical engineers near Parkersburg, W. Va. One of them, Addie F. Johnson, 19 years old, lives near Tallyho. She has had entire charge for three years of an engine which runs a grist and planing mill. She has a natural talent for machinery, and can take down and put together an engine as quickly and deftly as any experienced male engineer in this part of the country. The other woman engineer is Ida Hewett of Cairo, who has been a practical locomotive engineer for several years. Both are unmarried.

A NEW VOCATION FOR WOMEN.

A society of women piano-tuners has already been started in London, and this calls attention to the value of this employment for women, says a contemporary. Providing women have deftness of touch and delicacy of ear, there is no reason why they should not do this work, unless there may be difficulty in obtaining proper instruction. The greatest obstacle that might exist is the possible existence of a guild whose rules would exclude women. The work is light, congenial, in every way as desirable as that of music-teacher, and, so far as it goes, quite as remunerative.

THE VALUE OF MAKING A FUSS.

Many years ago a prominent clergyman was consulted by the ladies of his congregation about certain clerical work in which they were interested. Smiling at their earnestness, he said: "That's right, ladies, make a fuss—make a fuss! That's the only way to get work done in this world! Set about it yourself, and make a fuss while you do!" And so it is. Thinking about wrongs and sighing over them never mended one. But the people who exert themselves to right the wrong, making a good stir about it while they do, and worrying at other people to exert themselves too, will often force the other people into activity In sheer self-defense.—*Harper's Bazar.*

A WARNING.

My love puts powder on her face—
I feel quite sure of this—
For yesterday I dared to place
Upon her cheek a kiss.

And shortly afterward I chanced
Before a glass to walk,
And as I viewed myself I saw
My lips were white as chalk.

Next time I catch you, love, beware!
I'll hold you close, and then
I'll kiss you on your ruby lips
To turn mine red again.

—*Tom Masson, in N. Y. Sun.*

TWO WAYS OF SAYING IT.

"'Tis distance lends enchantment to the view,"
The sweet lined poets say and write;
But we who have much harder work to do
More simply say: "It's out of sight."

—*Detroit Free Press.*

WHY SHE MOVED.

Many years ago, when boundary lines between different states were being arranged, the final settlement of a line carried a certain house that had always stood in one state about a rod over into another. In the house lived a good old woman. She used to live in South Carolina, but was thus suddenly made a resident of North Carolina. When she heard of the change, she said:

"Now I'm glad on't. It's a good thing I've got into another state. I always heard South Carolina was a desperate unhealthy place to live in."—*Harper's Young People.*

TITLED MILLINERS OF OLD.

Lady milliners were known in the Stuart period. It seems the Duchess of Tyrconnell had a "stand of millinery in Exeter' Change—then a fashionable place of resort." Also, it seems, she disguised herself by a mask so as to hide her humbled pride, and eventually was pensioned off by James II, to save her family honor.

Jean Ingelow is now a gray-haired little old woman of 63 years. She is a kind friend of the poor, and at regular intervals gives them what she calls "copyright dinners" from the proceeds of her books.

Very much less than we think does our happiness depend upon what is external to us. If there be no heaven within, all the externalties of an outward heaven would be insufficient to produce happiness. —Reuen Thomas.

Capt. Mary Miller, the woman who managed a steamboat on the Mississippi for seven years and then secured a government license as pilot, has applied for the place of lighthouse keeper on the Gulf coast. She is an intelligent and rather prepossessing woman. Her husband is still an active navigator, and is running a steamboat in the Gulf.

The two erstwhile globe trotters of the feminine persuasion, Miss Elizabeth Bisland and Miss Cochrane ("Nelly Bly") are reported as thriving in their several walks. Miss Bisland, just from Europe, is to marry Mr. Charles W. Wetmore, a New York lawyer. Miss Cochrane is said to be wearing Parisian gowns and writing well-paid stories of the ephemeral and ineffectual sort. But both girls are getting on by self-help, and that's what American girls are born for.—*Evening Lamp.*

Miss Emma Sickles says that women in trying to prove their equality with men have entered so largely into purely masculine fields of labor that domestic affairs are in danger of being slighted by those from whom they should receive most attention, "Women's work calls for women," and in it women can make their influence as widely felt as in any other profession. Domestic science is as important as medical science. When the principles of hygiene are fully understood by women there will be comparatively little disease; and reform in the existing erratic methods of preparing food might usher in the millennium.

A woman who is at the head of a household has vast power and responsibility placed in her hands, says Maria Parloa in the *Ladies' Home Journal.* It rests with her to make the home a place where there shall be gained rest and strength for the battle of life; a place inexpressibly dear to each member of the family, where all shall feel that there is perfect freedom, yet where there is also perfect order. Some are born housekeepers, while others must work hard to train themselves for their many duties. But it matters not whether one be a trained or a natural housekeeper; if the work be done well and lovingly, the spirit of the head of the house pervades every part. One cannot always define it but one certainly feels it. Love, sympathy and charity must be there, else the best appointed household will fail to be a home for its members. The housekeeper must be patient, unselfish and industrious. Her reward will be the consciousness that her duty has been well done, and the possession of the love and respect of her family and friends. To my mind there is no position in the world of higher importance, or in which a woman can do more good.

BOILER EXPLOSION.

On the night Oct. 13 one of the seventy-five horse power boilers in the large heading factory of A. R. Coleman, Tipton, Ind., "let go," as the report says, completely demolishing the large building and scattering machinery all over the yard. The boiler was hurled fifty feet in the air and blown into a hundred pieces. There were fifty men and boys at work in the factory, most of whom were more or less injured, two of them perhaps fatally. The plant which was valued at $15,000, is almost a total wreck.

BURSTING OF A FLY-WHEEL.

Three persons were killed and six injured by the bursting of a fly-wheel at the Amoskeag corporation's No. 7 mill on the morning of Oct. 15, tearing through the floors of the first and second stories.

Eleven girls were employed in the drawing-room over the steam pumping room, adjoining the engine house. When the wheel burst they were carried to the basement in the debris. Some of them were caught in the heavy timbers and iron beams. The body of Engineer Samuel Bunker was taken out of the wheel pit with his head smashed.

Emil Duane, a boy employed in No. 5 mill, was taken from the mill in a terrible condition. He was in the top story, when a piece of the fly-wheel came through the window, knocking the timbers and filling-boxes in pieces, a mass of iron and timber striking him.

BRO. VENABLES WAS KILLED THERE.

From further details received from a member of the A. O. of S. E., and from the Boston *Herald*, we learn that the bursted fly-wheel belonged to the engine which killed Bro. W. W. Venables, Supreme Recording Engineer (A. O. of S. E.), in September, 1888; his body was found under the driving wheel, and it is supposed that he had been struck by a crank arm.

This latest catastrophe is described as follows:

The great fly-wheel attached to a mammoth Corliss engine, which furnished power for four big mills, exploded while running at tremendous velocity, tearing the three-story brick building all to pieces, ripping out the two floors as if they had been made of pasteboard, instead of brick and iron, and hurling pieces of metal weighing thousands of pounds hundreds of feet, in some cases over adjoining mills and into the river beyond.

The engine was the largest in the state, if not in New England. It was of 2000 horse power, built on the model of the great Corliss engine at the Centennial exposition.

The fly-wheel was 40 feet in diameter, with a 10-foot face, and drove two 40-inch belts, furnishing power to Nos. 4, 5, 7 and 8 mills of the Amoskeag corporation.

The engine room is located under the beaming room of No. 7 mill, in a building built against the mill proper and about 40 feet from mill No. 5, and was itself partly under and partly above ground. Steam was generated in a boiler room on the other side of the river and conveyed across in a viaduct.

What caused the catastrophe no one knows at present, and no one is likely to know, says the *Herald.* It was an accident similar to that which wrecked the Lynn electric light station, and, like that, may be unexplained. An instant before the explosion occurred sudden variations of steam had been noticed. Both water and steam power were being used, and Overseer Spence, looking into the engine room, saw that the engine was racing,

He rushed to shut off the water power, and he noticed that Engineer Bunker was trying to shut off the steam.

Then came the explosion, and a mass of debris marked the location of the big fly-wheel and its surroundings.

The report from the bursting fly-wheel sounded like that of a 120-ton gun, and the noise of falling timbers continued for some time, a perfect shower falling upon the surrounding buildings,

Then a scene of wild confusion ensued. The shrieks of the occupants of the beaming room over the engine room arose in heart-rending accents. The operatives rushed from adjoining mills, and a

crowd of weeping and half-frantic men and women sought to know the fate of relatives and friends.

The explosion was awful. The two sides of the building were leveled to the ground, and the third had a great hole, over 20 feet wide, cut cleanly through from the foundation to the roof. The roof, with the exception of a small section at one corner, was scattered to the four winds.

The velocity of the flying missiles was terrible. One piece flew straight up into the air about 200 feet and fell upon the roof of No. 7 mill, crashing through to the floor beneath, but fortunately injuring no one.

Three more ponderous pieces of iron were carried to the roof of No. 5 mill. One piece went into the roof and remained there, and another piece went into a corner window, taking the sill with it. In this room, beneath this window, sat a boy about 12 years old named Emil Duane. The iron went into the window past the boy, but the splinters and pieces of glass dashed around him, and he was severely bruised and cut and badly frightened.

The corporation authorities quickly entered upon the work of rescuing the imprisoned victims and removing the bodies of the dead. Assistant Engineer Dalton was the first one found. He was discovered beneath the ruins of the engine, and, remarkable to say, he was not killed. When found, he was able to talk, and was carried to the outer air. He was severely bruised and cut, but was saved from instant death by the way the timbers fell over him.

Dalton said that Engineer Samuel J. Bunker was down beneath him in the belt pit. The searchers found the engineer in the bottom of the pit dead. He had been killed instantly. A piece of flying iron had struck him on the head and smashed that part of his body to a jelly. Strange to say, his body was not otherwise cut.

Mrs. Ida L. Cram had her left arm and leg broken, and was badly cut and bruised about the head and body. She died at the Elliot Hospital.

Miss M. Kane sustained a terrible scalp wound. She died. She was a beautiful young woman 21 years of age.

Miss Lena M. French was terribly bruised, and suffered severely from loss of blood. She is not expected to live.

Mrs. Mary Richardson was cut about the head and face, and both her legs were fractured.

Susie Brookings was badly bruised about the head and body, and had several bad cuts about the face.

Louise Martel was severely bruised, and is suffering from the shock.

Melvina Martel was severely injured about the head and body by falling bricks. One arm was broken.

Mary McNab was severely injured about the body and probably has several broken ribs.

Nellie Boardman was cut and bruised about the head and body.

Patrick Brannon had gone down to see what the matter was with the steam. He had just left the engine room to return to the mill where he was employed, and when he had gone perhaps 50 feet the disaster occurred, and he was struck by the flying debris and severely injured about the head and body.

Lemuel Levick, second hand in the beaming room, had a thrilling experience. He was at work beside a cupboard. He says the building literally collapsed without the slightest premonition. The first thing he knew the floor gave way beneath, and he and all the machinery and girls in the room were plunged into the wreck below. Fortunately, the cupboard, as well as Mr. Levick, maintained its equilibrium, and when they had both brought up in the pit of the engine room the cupboard saved Mr. Levick's life, for timbers and iron and bricks had fallen all about and upon the cupboard, and some of the falling timbers, by resting upon it, had formed a cave in which Mr. Levick was secure from harm. The steam escaped in great volumes, rising in clouds all about him. Just outside of the cavern of refuge in which Levick stood was a girl, one of his employes, whom the steam was literally scalding alive.

Levick seized her, and, by dint of tremendous exertion, pulled her inside the inclosure in which he stood.

Levick escaped everything except superficial bruises, but his clothing was torn to shreds, and he was covered with mud and brick dust and dye from head to foot.

Ex-Representative Marcellus Gould, superintendent of the Amoskeag carding department, had probably the last words with Samuel J. Bunker, the dead engineer. Mr. Gould went to the engine room to see what caused the depression in power in No. 5 mill. This was a few moments before the accident.

He saw Mr. Bunker and told him that the power had decreassd in that mill, and asked him what caused the trouble.

"There is nothing that I know of," said the engineer, "but I'll see," and he started to go down into the pit, after directing his assistant, Thomas F. Dalton, to look after certain other parts of the work.

Mr. Gould then left the engine room and went by way of a tunnel to No. 5 mill. He had proceeded but half the way to the new mill when he heard an indescribable crashing and roaring. He had escaped with his own life by the narrow margin of one minute.

Mr. Gould hurried through the basement of the adjoining mill and out on to the rear street. There a horrible sight met his gaze. In one minute's time the engine room and that portion of the No. 7 mill which was on the west of the engine and steam pump rooms was a complete wreck. Only a portion of the walls of No. 7 mill was standing, and this was cracked and tottering.

Assistant Engineer Dalton's version of the occurrence is as follows:

"There had been a lack of steam all the morning, and the speed in the rooms run by this engine had been low. More speed was requested and Mr. Bunker went down into the tank, where his body was found, to see about the matter. I stood near the engine, on the north side, and just after he went into the tank saw that the engine was racing, or getting beyond control. Before anything could be done the fly-wheel burst into fragments and the building was a wreck."

The wrecked fly-wheel now looks like the wheel of a domolished wagon that has lost its rim and a portion of the spokes. When the flying pieces wrecked the building, some of the timbers and wreckage fell within range of the monster spokes and were ground to pieces like so much kindling wood.

The wheel weighed over 68 tons.

ANOTHER FLY-WHEEL BURSTED

Cincinnati, Ohio, Oct. 18, 1891.—On September 25th an accident took place at Hunt Street power house of the Consolidated Street Railroad Company's electric station. The fly-wheel of one of the large engines burst and the pieces went every way, some through the roof, taking out one truss section, some through the south wall near smoke stack knocking down one line of 12 inch main steam pipe. Other pieces went through the north wall, tearing down one end of a fine switch board. Several pieces weighing hundreds of pounds went 300 yards away from the power house.

Only one man was hurt; Patrick Kinney had his arm broken near the elbow.

This is a new plant and it had only been in operation a few months. The cause of the accident was a short circuit which caused the engine to run off and the wheel went to pieces. The wheel was 22 feet in diameter, 4 feet face and weighed 20 tons. The engine is a Lane & Bodley Co.'s Corliss, 28x60, and runs 68 revolutions per minute. The estimated loss is between $10,000 and $15,000. The engine was not hurt much. Frank S. Neal, G. C. E.

A MOUNTAIN EXPLODES.

A strange story comes from the City of Mexico, to the effect that a traveling man, named Vincente Loaiza, arrived in that city Oct. 9, and tells a most remarkable story. He says that he had occasion to visit a town twenty-five leagues south of Teluca the previous Monday. While there a small mountain about half way between the towns of Tennancingo and Tecualoya exploded with a most terrific report. Immediately an immense volume of water commenced to flow from the newly-formed crater and inundated much of the surrounding country. The Indians fled to the hills and the church bells in the surrounding villages were rung violently. A general panic ensued. The water soon found its level and poured through a gorge fifteen feet deep, and continued so to flow until the next day, when Mr. Loaiza left. The inhabitants were so frightened that they would not approach the stream. Mr. Loaiza did not take the temperature of the water, but he supposes it was hot, as he saw vapor rising from it on a warm day. The volume of water was so great that it carried away two high bridges which crossed the ravine far above water mark. The crater formed by the explosion was quite large and rock and earth were scattered far and wide. Mr. Loaiza is not a scientific man, but is intelligent and reliable, it is said.

A NEW ORGANIZATION.

The American Order of Steam Enignees—Its Objects.

On last Thursday night District Deputy Geo. W. Rose completed the organizatian of a Council of the American Order of Steam Engineers in this city with a good charter list. The local council starts off with good prospects. The platform of the Order is one which every man that handles steam can stand providing he is of good moral character and can stand the examination. The objects of the Order are educational and benevolent. The Order has a life insurance and total disability plank attached to it. Each member carries $2,000 insurance against death and accident, and in its council meetings the most of the time is taken up in blackboard exercises and working problems connected with steam engineering. The Order is very strong in all of the Eastern States and has commenced to spread out through the Western States very rapidly.

The locomotive, marine and stationary engineers all join together for one purpose—that of education and benevolence. After the organization the following officers were elected to serve the remainder of the term:

P. C. E.—L. W. McCrary.
C. E.—Geo. W. Rose.
F. A. E.—Fred W. Lickey.
R. E. and C. F.—V. B. Adams.
F. E.—M. C. Browning.
T. E.—Geo. D. Partington.
Chaplain—S. F. Tucker.
S. M. M.—S. A. Williams.
J. M. M.—Corles D. Wilson.
I. S.—Adam Kline.
O. S.—Wm. P. Blanchet.

The Order is bound to grow and increase, as it has for its foundation something that appeals to every engineer in this city.

The Journal wishes the Order prosperity and success.

It is not thought probable, now, that there will be any tower at the World's Fair. The projectors of the most promising tower scheme abandoned it when they found that they would have to take down their tower when the exposition closed, because the Park Commissioners refused to grant any subsequent use of a site.

The lumbermen of the Puget Sound region were called to meet at Tacoma on Oct. 6, to consider the question of furnishing material for the Washington state building at Chicago, and to plan for an extensive and complete lumber exhibit. The executive committee of the Washington World's Fair Commission was called to meet at the same time.

NEW ENTERPRISES.

ILLINOIS.

A large building will be erected at Franklin Park for the manufacture of military and band uniforms, regalias, etc. The company will have a capital of $500,000 and will employ not less than 250 men and women. Information can be obtained from Mr. L. Franklin.

Secretary of State has issued incorporation license to the Belleville Electric Railway Co., at Belleville to operate an electric railway; capital stock, $100,000. Incorporators, Jas. A. Atterbury, Jos. Fuess and others.

The estimates are all in for the manufacturing plant of the Gray Electric company to be built at Highland Park, Ill., for which Architects W. W. Boyington & Co. have made the designs. It will be 60x140 feet in size, three stories high, with a clock tower sixty feet high. It will be of pressed brick and stone, with interior of mill construction, electric light and elevator. The office will be completed in hardwood and heated by steam. Cost of the buildings, $25,000.

Chicago.

The Illinois Railroad Co., will build a boiler house at Indiana Ave., near 16th St.

J. W. Ostrander will build a seven-story factory at 88 and 92 W. Jackson St.

J. P. Wolf Manufacturing Co. will build a factory at 1314 Bronson St.

George Hankins, eight four-story flats and one-story boiler house, at south east corner of Twenty-sixth street and Indiana avenue, $75,000.

Otto Young, sixteen-story office building, at north west corner State and Madison streets, $288,000.

C. C. Landt & Co., four two-story dwellings, at Nos. 413-19 Forty-first street, $12,000.

J. M. Van Osdel & Co. are preparing plans for the fourteen-story building J. W. Ellsworth proposes to erect on his property, 75 feet front, running through to Third avenue, on Dearborn street, 50 feet north of Harrison street. The building will cost about $250,000. It will contain 150 offices. Work will commence as soon as possible.

Louis Hallberg has finished plans for a pair of residences to be put up on East Huron street, near St. Claire street. for Mr. J. Mountain, to cost $18,000; also the factory for the Gilbert & Bennett Manufacturing Company on Sixteenth street, near Western avenue, 40x170 feet, four-story, to cost about $30,00; also spacious flats on North Clark street, to cost $20,000.

Secretary of State has issued incorporation license to the Wagner Electro-Medical Co. at Chicago. This company will manufacture physicians' and surgeons' supplies; capital stock. $25,000; incorporators, Howard Crutcher, H. J. D. Parker and D. V. Samuels.

L. Z. Leiter will erect a 13-story office building at 299-301 Wabash Ave. The cost of this building will be $245,000. Will contain boilers, engines, electric lights and elevators.

The construction of the Grant Locomotive works is being carried on as rapidly as possible for such a large enterprise, a force of over 250 men now being at work. So far eight of the most important buildings are well advanced, most of them being under roof. These buildings comprise the machine and erecting shops, blacksmith and hammer shops, boiler shop, paint and wood shops, the foundry with its three annexes, the boiler-house and the dynamo-house, work not having yet been commenced on the office and pattern shop. The largest of the buildings is the machine and erecting shop, which fronts on Robinson avenue 110 feet, and extends back—it being an L-shaped structure—370 feet. The walls are up and the roof is on, the height of the building to the seat of the roof-trusses being thirty-seven feet. The contractors are under bonds to have the work completed by Nov. 2, but it is thought that this cannot be accomplished before the middle of the month, when the equipment will begin to arrive and will be placed in position so that the whole establishment can go into operation early in January, giving employment to about 1,200 persons.

The papers of incorporation of the Savoy Theatre Co., which proposes to build a 12-story theatre and office building on the site of the 1st Regiment Armory at a cost of $600,000, have been issued. Incorporators are Geo. W. Henry, Jno. A. Dickinson, A. Benton Bonds.

J. W. Ellsworth will erect a 14-story office building at 353-355 Dearborn St. It will have a ground area of 75x67 ft., and will be fitted with elevators, steam heat and electric lights. It will cost $250,000. Work will be started as soon as plans are finished. J. M. Van Osdell & Co., architects.

Wilson & Park are erecting a 4-story apartment house to be fitted with electric lights, elevator, laundry, dryers and steam heat. Cost $40,000. Wilson & Marble, Insurance Exchange Bldg., architects.

A. A. Libby, Jr., is building a 4-story factory and one-story boiler house at 2813 Haynes St. Cost $12,000. H. P. Harned, architect.

Articles of incorporation with $30,000 capital stock have been granted to the company known as the Engineers Society Auxiliary Association of Chicago. Incorporators Eng. Benezette Williams, Chas. McRitchie, and Architect Henry Ralia. The purpose of the Association is to erect a fine office building somewhere down town, in which are to be located the headquarters of the Western Society of Engineers.

F. B. Abbott, architect, is drawing preliminary plans of a seventeen-story and basement office structure to be constructed on Dearborn street within two blocks of the government building. The realestate deal is now being made by a prominent firm in that line, and it is quite probable will be consummated this week, when building operations will be commenced. The proposed edifice will cover 115x165 feet of space, and will be of steel covered with terra cotta. It will be entirely fireproof, with "mackolite" partition walls, three or five elevators, steam heat, electric lights, mosaic floors in the corridors, and hardwood trimmings. It will represent an investment of about $350,000.

J. M. Van Osdel & Co., architects, are perfecting plans of a fourteen-story office building for J. W. Ellsworth, the coal dealer, to be put up at 308 Dearborn street. It will have a frame of steel, covered with stone, brick and terra cotta, and covering an area of 75x67 feet. The inside will be treated in an elaborate manner, with mosaic floors, marble wainscoting, three elevators, steam heat, hardwood work and electric light. Cost $250,000. Ground will be broken for this improvement as soon as the plans are ready.

Chicago will have a new Manual Training School for boys. Allen C. Lewis, who died some fourteen years ago, left the bulk af his estate in trust for the establishment of a Manual Training School for boys in the city of Chicago. Property has been purchased on W. Van Buren St., running from Morgan west to the Bowery and south to an alley corresponding with Tilden Ave. The aggregate cost of the complete site is $103,000. The main building will face on Van Buren and may cover the entire ground from Morgan to the Bowery, The engine house and subordinate buildings will be located on the ground running south to Congress St. Immediate steps will be taken to erect the buildings.

Clinton J. Warren has nearly completed plans for the apartment house which he will construct on the ground which he and A. W. Maltby recently purchased at the south east corner of Clark street and North avenue. The building will be eight stories high and will be 225x125 feet. The walls will be of pink buff pressed brick and terra cotta. There will be broad entrances from both streets and two passenger elevators. The interior construction will be fireproof with tile partitions and hardwood finish.

MICHIGAN.

Nashville City is to build a stand-pipe in connection with their water-works.

Traverse City has given a bonus to Mancelona Oval Wood Desk M'f'g Co. to bring their factory to Traverse City, and enlarge with modern tools and machines.

Ludington is to extend its water-works suction pipe 2,000 ft. into Lake Michigan.

A $35,000 hotel will be built at Ludington, with steam, hot air, or hot water heating.

Mancelona has voted for a $15,000 water-works.

MISSOURI.

The St. Louis & Suburban Railway Co., have just changed from a narrow guage to an electric line and will extend from 61st and Locust Sts. to Flousant, taking in the first cable road built in St. Louis, the St. Louis Cable & Western. As yet they only run the electric line from the terminal of the cable, but will soon extend it the whole length of the line.

The power station is designed for three Corliss engines, they have only one set up and running. It is a Hamilton Corliss 30″x72″, the other two will be 30½x72″. Although the engine now running has only been running for two weeks it was working very smoothly, making 63 revolutions a minute. The engineer, Mr. J. V. Starr, an old river engineer, superintended the work of setting up, and he took a half dollar and set it up on its edge on the end of the slides and it stood for over 10 minutes before falling, showing how smoothly it was running. The fly-wheel is 24′ diam. 74″ face, and weighs 42 tons. The belt driving the shafting is 72″ wide, and 152′ long; it weighs 1 ton. The line of shafting made by the Hill Clutch Co., is 110′ long, 9″ diam., and has 12 pullies and 13 clutches, each 10′ diam. The generators are of the latest type, manufactured the Thomson-Houston Co., 100 h.p. each. They have 6 boilers 70″x20′; 25,6″ flues, two in a battery, and for their supply pumps they use Hooker Duplex 7″ plunger.

NEW YORK STATE.

Articles of incorporation of the Syracuse & Oneida Lake Railroad company have been filed in the County Clerk's office. The proposed road will begin near Messina Springs, connecting with the Syracuse, Eastwood Heights & De Witt road, and run north to South Bay, on Oneida lake, and thence easterly to a point near the shore of Oneida lake and on the line between Onondago and Madison counties. The road will be broad gauge, and its length, including sidings, will be twelve miles. The capital stock is $125,000 in shares of $100. Each of the fifteen incorporators has subscribed for eight shares. The term of the company's existence is to be ninety-nine years, and its principal office will be in Syracuse.

The board of directors consists of Nelson L., Luzerne A. and Mowry S. Williams and Messrs. Leonard, Johnston, Tefft, Warner, Johonnot and Walter.

OHIO

After much competition, it is said, the contract for electrical equipment to be used on the East Liverpool & Wellsville Railway has been awarded to the Short Electric Railway Company. The road will be about eight miles in length, connecting Ohio City, Wellsville and East Liverpool, with the power station in the last named place. Eighty-two pound Johnson girder rail will be used throughout the entire roadbed, grading for which has been pushed vigorously. A force of five hundred men has been at work for two weeks on the roadbed, which has been cut and filled according to the best practice for steam railways, and will when completed be practically level. Thirteen acres of ground have been purchased in East Liverpool, on part of which a handsome red brick power station is in process of erection. Power will be furnished by two one hundred and fifty h.p. Reynolds-Corliss engines with accompaniment of two three hundred h.p. boilers and a Worthington duplex pump. Two Short multipolar slow speed dynamos of one hundred and fifty h.p. each, and a handsome marbleized slate switchboard of the latest Short type, fitted with all necessary appliances for the modern electric power station will complete the equipment of the power station.

Seven twenty-six foot car bodies have been purchased of the J. C. Brill Company, Philadelphia. These will be equipped with fourteen Short "gearless" motors, having a capacity of twenty horse power each. Line construction will be Short system throughout.

It is expected that the road will be put in operation on Thanksgiving Day, when the citizens of the

two enterprising towns have arranged to decorate their streets and cars, and to give a banquet in honor of the occasion. At this writing the usually quiet streets of both East Liverpool and Wellsville are filled with foreign workmen, several hundred men being employed at different points along the line. The greatest enthusiasm has been shown from the start by the people of the two towns, the cause of their hearty co-operation being immediate relief from the steam cars which have been their only method of communication thus far.

Choral Director Tomlins has returned from Europe much elated over his success in inducing the best trained and most celebrated choirs abroad to come to Chicago in 1893 to participate in the proposed choral contest.

LITERARY.

Making and Using Steam.

An advance copy of a good book on steam heating has been received from the Mason Regulator Co., of Boston, who have bought the edition now in the press. It is the second of a series they intend to publish on different subjects. This one contains just the facts which every one wishes to know who has a steam plant. The price is 25 cents (post paid). Wm. Harrison Bailey, M. E., of Rochester, N. Y., is the author; and when he writes on steam engineering he knows whereof he speaks. Many of our readers will be specially interested in the chapter on "Engineers and firemen," although the author therein puts the cart before the horse.

The Steam Engine.

A Manual of the Steam Engine, by Prof. Robt. H. Thurston, the well known director of Sibley College, Cornell University, cannot fail to be interesting and edifying to all steam engineers. The volume now before us is Part I, being on Structure and Theory. It is a large book of nearly 900 pages, adequately indexed, profusely illustrated and strongly bound. Published by John Wiley & Sons, New York, (Chicago agents: A. C. McClurg & Co., Wabash avenue.) Price $7.50.

The author has endeavored to condense the essential facts and principles constituting the theory of the steam engine, both in the ideal form usually assumed by older writers and in the actual form familiar to the practitioner and also to give the more important facts and methods of its design. construction, maintenance, operation and trial. This first part contains the salient points of theory and an account of the gradual development of the engine from the crude forms of earlier times to the elegant and efficient types familiar to the engineer of the present day, and also a description of the general structure and the various special forms of the modern engine

Prof. Thurston is a Doctor in Engineering, and he has written his book on the assumption that every one who will read it is familiar with the higher mathematics and the principles of thermal physics, and generally well read in those subjects which constitute the essential scientific basis of the professional training of an engineer. To such people, therefore, this book is most valuable. In other words the readers must be pretty well educated in order to follow the author intelligently and profitably.

TRADE NOTES.

The Sternes Manufacturing Co. of Syracuse, N. Y., expect to start up their new 300 h.p. Cooper Corliss engine next week.

The Union Porcelain Works of Brooklyn, N. Y., have issued an illustrated pamphlet showing hard porcelain insulators and electric fittings. It is their List No. 4.

The lively town of Brookville, Ind., is now putting in water works. The contract for the pumping engine, boilers heaters, etc., was awarded to the Laidlaw & Dunn Co., of Cincinnati, O., who are now doing a large business in water works pumping engines.

The Palace Hotel, San Francisco, Cal., has ordered a 200 h.p. cross compound engine from the Ball Engine Co., Erie, Pa., for their electric light plant. The Palace Hotel is now using a 100 h.p. tandem compound engine manufactured by the Ball Engine Co., (Erie, Pa.) with satisfaction.

The Electric Light Co., of Syracuse, N. Y., have commenced placing an E. P. Allis Co. Corliss engine on the foundation in their new addition to their plant. The new engine is a a 24x60 condensing, and is to drive six Thomson-Houston genarators of 80 h.p. each. The power is to be used by the street car lines of the city.

Magnolia anti-friction metal gives great satisfaction—and pleasure. A novel illustration of this has come to our table. It consists of a paper showing the oilman with his eyes closed as if tired unto death, until he sees Magnolia coming to his aid, then he smiles—audibly almost—and his eyes are joyfully open. When the card is down on the table Magnolia is out of sight, but when it is held up between the eye and the light Magnolia appears, and with it a great transformation.

The Almy Water Tube Boiler Co., of Providence, R. I., have supplied to Seattle, Washington, two boilers of 120 and 200 h.p. respectively, to be used on light-draft stern-wheel river steamers. They have under construction one 150 h.p. boiler for emergency fire pump service. Also one for service in running diamond drill prospecting in Mining Mountain region, west coast of Mexico; two for heating a hospital; two for greenhouse work (in the largest greenhouse in New England); one for an 80 ft. yacht for a party in Boston, Mass., and one for a steam launch in Florida.

Walbridge & Co., Buffalo, wholesale dealers in general hardware, who were burned out less than a year ago, have rebuilt on the site, a substantial building, with dark red sandstone trimmings. It is seven stories high, fronts on Washington street 62 ft. and on South Division street 145 ft., and is a credit to the firm and the city of Buffalo. It is equipped with one 60 h.p. boiler, fed by a Snow pump through an Otis heater; it has one Howard elevator run by a Snow pump; it has the Edison system of electric lighting, run by a 15 h.p. Rice automatic engine. 150—18 c. p. incandescent lamps. It is equipped with the latest system of fire alarm and extinguishers. The plant is in charge of genial Brother Harry Parson, Past Chief Engineer of Jefferson Young, Jr., Council, No. 14, and it can be safely said that he is the right man in the right place; and will always be found at his post during working hours.

The Sioux City Engine Works report that in spite of the financial depression in the country, their business has kept up very good, having been obliged to work a night shift almost constantly for the past four months. During the past month they have placed orders for the following: One 150 h.p. Sioux City Corliss engine and a 150 h.p. Stirling water tube boiler to J. H. Hertsche of Hamburg, Iowa. One 50 h.p. Gidding's automatic, and an 80 h.p. tubular boiler to the Commercial Electric Power Co., of Lincoln, Neb. One 100 h.p. Stirling boiler to the Sioux City Oat Meal Co. One 60 h.p. Sioux City Corliss, and two 80 h.p. Stirling boilers to the Fremont Brewing Co., of Fremont, Neb. One 12x18 Gidding's automatic (fourth engine) to the Moline Plow Co., Moline, Ill. One 100 h.p. Gidding's automatic compound engine for the Nebraska State University at Lincoln, Neb., together with several other large sales which will be closed within a few days. In addition to the above, they have placed in their works a 60 h.p. Gidding's automatic compound which retains the same elements of simplicity for which the standard Gidding's automatic has become so popular. The trade on the Sioux City Corliss engines is steadily growing toward the larger sizes, and they are now bringing out some of the stiffest and heaviest engine beds built in this country, especially designed to withstand the heavy fluctuating loads of electric railway service. They are now negotiating with several large roads to furnish them their new design 48 inch stroke Corliss engine up to 350 and 400 h.p. These same sizes are built by this company up to 500 h.p. or in pairs of 1000 h.p. capacity There is every indication that the output of the works this year will be double that of last year.

SITUATION WANTED

As engineer, by a thoroughly experienced and reliable man, highly recommended. Address "Steam," care of The American Engineer, 1302 Pontiac Building, 358 Dearborn street, Chicago.

CHICAGO, MILWAUKEE & ST. PAUL RAILWAY.

Electric Lighted and Steam Heated Vestibuled Trains, with Westinghouse Air Signals, between Chicago, St. Paul and Minneapolis, daily.

Electric Lighted and Steam Heated Vestibuled Trains between Chicago, Council Bluffs and Omaha, daily.

Through Vestibuled Sleeping Cars, daily, between Chicago, Butte, Tacoma, Seattle, and Portland, Ore.

Solid Trains between Chicago and principal points in Northern Wisconsin and the Peninsula of Michigan.

Daily Trains between St. Paul, Minneapolis and Kansas City via the Hedrick Route.

Through Sleeping Cars, daily, between St. Louis, St. Paul and Minneapolis.

The finest Dining Cars in the World.

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Everything First-Class.

First-Class People patronize First-Class Lines.

Ticket Agents everywhere sell Tickets over the Chicago, Milwaukee and St. Paul Railway.

STEAM HEATING.

By one who has paid for his experience, is the title of a new book which we have published, without advertisements, and bound in leatherette, similar to our "Key to Engineering," of which we sold nearly 2,000 copies. The price by mail is 25 cents. Stamps taken. Ready for delivery Nov. 1st. Please mention this paper.

Mason Regulator Co., Boston.

Map of the United States.

A large, handsome map of the United States, mounted and suitable for office or home use, is issued by the Burlington route. Copies will be mailed to any address on receipt of 12 cents in postage by P. S. Eustis, Gen'l Pass. Agent, C., B. & Q. R. R., Chicago, Ill.

NEW! NEW!

FOR MANUFACTURERS.

Who wants to buy a small new machine for imitation and exploration in America. Sole machine in the world of first necessity for manufacturers of chocolate, and patented only in Europe. Please address offers, if possible in German, to C. N. 27850, care Rudolf Mosse, Berlin, S. W. (Germany).

CONTRACTS OPEN.

Proposals.—Sealed proposals will be received at the office of the Illinois Board of World's Fair Commissioners. Room 18 Montauk Building, in Chicago, until 12 o'clock m. on the 18th day of November, 1891, for all the labor and material required for the erection and completion of the Illinois Building for the World's Columbian Exposition at Chicago in accordance with the drawings, general instructions, conditions, and specifications (copies of which may be seen at the office of the Commissioners in Chicago and on application to the architects, W. W. Boyington & Co., 157 La Salle street, Room 107, on and after Oct. 26, 1891.)

Each proposal, whether for a part or the whole of the work, must be accompanied by a certified check for a sum not less than 3 per cent of the amount of the proposal, drawn in favor of the Director-in-Chief of the Illinois Board of World's Fair Commissioners.

The Commissioners will reject all bids received after the time herein stated for opening the same, also bids which do not strictly comply with all the requirements of this invitation. The Commissioners also reserve the right to reject any or all bids. Proposals must be inclosed in sealed envelopes, including schedule of work and material and check, and marked "Proposal for the Illinois State Building for the World's Columbian Exposition," addressed to John P. Reynolds, Director-in-Chief of the Illinois Board of World's Fair Commissioners. This 15th day of October, 1891. W. C. Garrard, Secretary Illinois Board of World's Fair Commissioners.

Pumping Machinery.—Sealed proposals will be received by the Board of Water and Lighting Commissioners of the city of McKeesport, Pa., until noon on the 5th day of November, 1891, for the furnishing and erection of two (2) three million gallon horizontal duplex direct acting, compound condensing, or non-compound condensing, rotative pumping engines, of the outside center packed water plunger pattern, for the McKeesport Water Works; together with all appurtenances and connections thereto, as set forth in the specifications for said engines, now in the office of the Superintendent of Water Works.

Said Board of Commissioners reserve the right to reject any or all proposals.

Copies of specifications will be mailed upon application. All proposals shall be endorsed "Proposals for Pumping Machinery" and directed to the undersigned. By order of the Board. Jos. Ecoff, Superintendent.

Approaches to U. S. Court House, Etc.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock p. m. on the 5th day of November, 1891, for all the labor and materials required for the approaches to the U. S. Court House and Post Office, at Texarkana, Ark. Texas, in accordance with the drawing and specification, copies of which may be had at this office, or the office of the Superintendent at Texarkana, Ark., Texas. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in envelopes, sealed and marked, "Proposals for the Approaches to the U. S. Court House and Post Office building at Texarkana, Ark., Texas," and addressed to W. J. Edbrooke, Supervising Architect.

Steam Heating Apparatus.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock p. m. on the 26th day of October, 1891, for all the labor and materials required to remove the old heating apparatus, and fix in place complete a new low-pressure, return circulation, steam-heating apparatus for the U. S. Custom House building at Cairo, Ills., in accordance with drawings and specifications copies of which may be had on application at this office, or the office of the custodian of the building at Cairo, Ills. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal. The department will reject all bids received after the time herein stated for opening the same; also, all bids which do not comply strictly with all the requirements and meaning of this invitation. Proposals must be inclosed in envelopes, sealed and marked "Proposals for the New Low-Pressure, Return-Circulation, Steam Heating Apparatus for the U. S. Custom House, at Cairo, Ills., and addressed to W. J. Edbrooke, Supervising Architect.

OCTOBER 31, 1891. The American Engineer. VOL. 22, NO. 18.

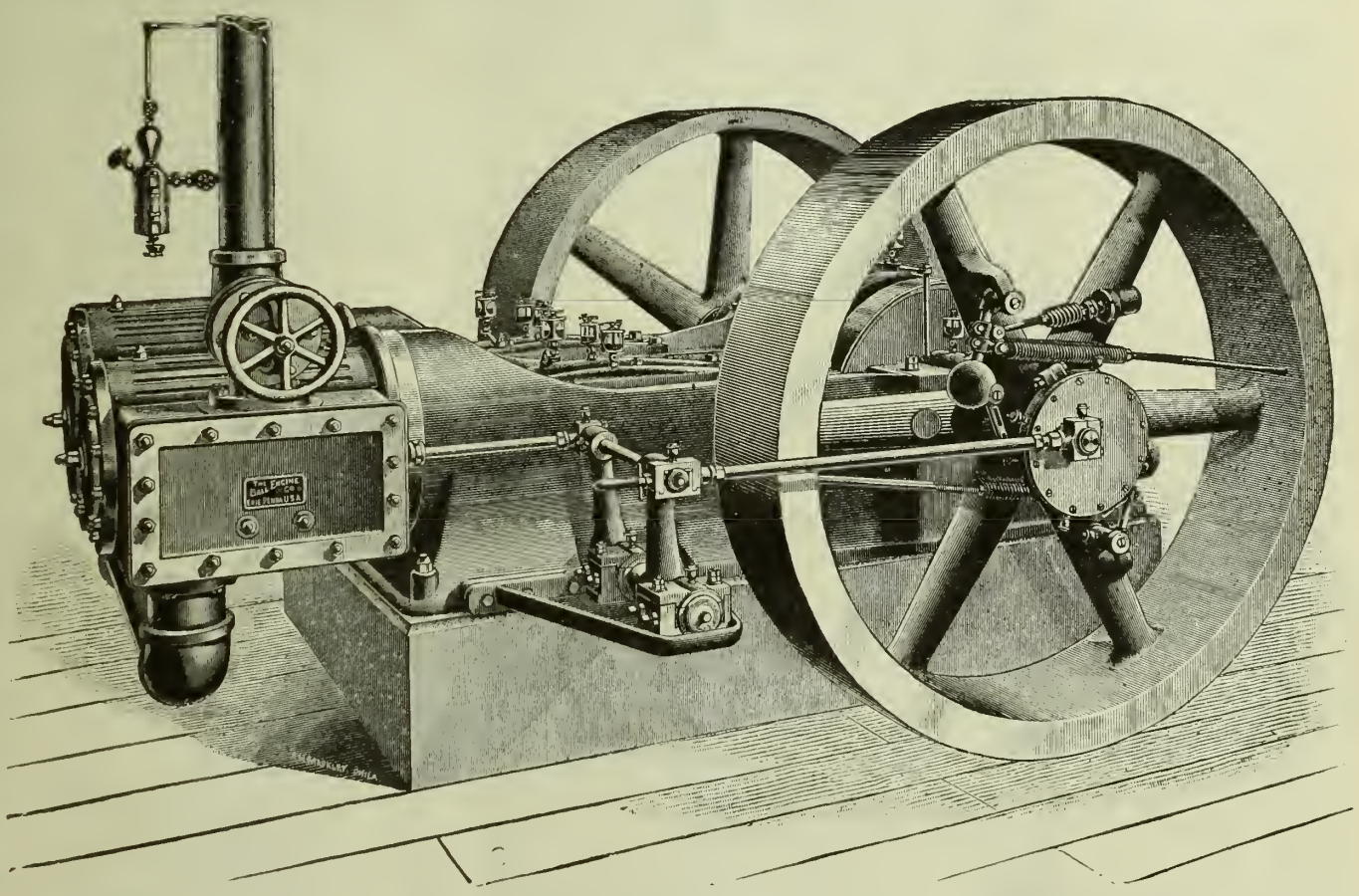
BALL CROSS-COMPOUND ENGINE.

Electricity has made it necessary to make engines to co-operate with it, or rather to put electricity in useful form, of a particular build. The accompanying illustration shows a cross-compound engine for electric light stations, which the Ball Engine Co., of Erie, Pa., began to build two years ago, and since then there has been a great demand for them. Their first engines of this type were built for the new electric lighting station of the Edison Illuminating Company, of Brooklyn. It was decided to build these engines in the form of a double or cross compound, as it was believed that a higher rotative speed could be successfully used when the work was distributed over two sets of crank pins and journals, rather than with the use of a single set of bearings of a larger size, as in the case of a tandem compound engine, developing the combined power of the double compound. The engine was specially designed for heavy work, and all the parts were made unusually large and massive. It is believed to be the largest and heaviest engine of its type ever built.

The crank shaft is made of the best open hearth steel with the cranks opposite each other; one counteracting the effect of the other, so that the engine is perfactly balanced and capable of being run at a high speed with quietness and ease, and without heating. All the parts of the engine are of first-class materials, and are finished with the greatest care. The valve provides for quick admission of steam and insures against all possible leakage. The pistons are readily accessible; the improved governor gives good regulation. Instead of using the eccentric and strap on the low pressure side, as is commonly done, an adjusted wrist pin-plate is bolted directly to the hub of the wheel. On this plate is the valve driving crank-pin.

On account of the small area of the crank-pin, there is but little wear and little oil required. The valve operating mechanism is simple and reliable. The engine, as a whole, is a pattern of simplicity, durability, strength and economy.

The Ball Engine Company, Erie, Pa., build a special cross compound engine for street railway work, and have a number of engines in successful operation in this work. Among the large street railway generating stations using this engine are the Rochester Street Railway, Rochester. N. Y., and the Buffalo Street Railway, Buffalo, N. Y. The results under very trying conditions are said to be entirely satisfactory. The often expressed desire of large central station and other practice for an economical and reliable engine of medium power and occupying a comparatively small space, has been met (as the *Electrical Review*, New York, says) by the cross compound engine, specially intended for variable load and close regulation under changes of speed and boiler pressure.



The Illinois World's Fair Commissioners have provided for the preparation of a number of topographical maps of the state for exhibition at the Exposition. One will show in detail the railroads, of which Illinois has a greater mileage than has any other state, with their grades and elevation above both Lake Michigan and the ocean. Another will show the river courses, valleys, elevations and extensive prairies, illustrating the resources of the state for agricultural purposes. A map is being prepared showing the location of every schoolhouse and all of the state institutions of various descriptions.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

The following are the topical questions for the New York meeting of the above-named society, next month, (Nov. 16-20):—

89. Has anyone ever tried to standardize sizes for keys? If so, what are his sizes.

90. Have you had any experience in out-door work at night, in wind and storm, with portable apparatus for light in large quantities, other than electric light?

91. What is the best design for line shafting, transmitting over fifty horse-power, permitting them to be stopped and started on any floor, without interfering with the motor or other shafting?

92. What is the best method of correcting for the super-heating of steam in figuring a boiler test.

93. In arranging chimney stacks for a battery of boilers, is it best to use one for each pair, or a large chimney for the entire battery?

94. Will there be any difference in the size of the chimneys required, when the boilers are the ordinary tubular type, or of some of the water-tube forms?

95. What is the best form of cylinder lubricator for engines carrying 140 lbs. of steam pressure or over?

96. What are the maximum safe speeds for hoisting and traversing in an over-head traveling crane in a machine shop?

97. Is there any advantage in using a circulating device for the water inside a boiler, particularly of the three-furnace Scotch form.

98. Is there any best way to group the tubes over the cylindrical furnaces of a Scotch boiler.

99. Will a forced circulation of air under a floor near the ground prevent decay of the woodwork an floor timbers?

100. Why should anyone cut a half-inch bolt with 12 threads to the inch? Is there any objection to the U. S. Standard of 13 threads?

101. Have you any facts to show that there is a molecular change in metals when their temperature is raised or lowered?

102. Have you any data as to earth-work dams which would suggest the factor of safety with which they have been built?

103. What have you found is the best form of straightening machine?

104. Have you had any experience with systems for purification of bad feed-water before it gets into a steam boiler, either by precipitation or otherwise?

105. Is it better or not to have the lead increase with the load in high speed automatic engines, and if so, why?

106. Are there not anvantages to be claimed for a medium amount of back pressure and high compression lines in the same class of engines?

107. Has anyone tried sand-blasting as a method to produce a surface on cast-iron before nickle-plating?

108. Is there any better method than jappaning to protect steel from corrosion?

109. What kind of wheel is best for grinding and beveling glass-plate? What is best surface speed?

110. Which is the best process to repair old files, sand-blasting, etching or re-cutting? Do any of them really pay?

111. Is there any reason why diametral pitch should not be used for very large gears, instead of circular?

The following papers are also to be read and discussed:—

Experiments to determine the rate of Rise or Fall of a mercurial Thermometer under different conditions.—Test of Indiana Block Coal at the Chicago West Side Pumping Station.—Limitations of Steam Engine Economy; by A. F. Nagle.

The Value of Water Power, by Chas. T. Main.

The Brooklyn Pumping Engine of 1860, by Samuel McElroy.

The Idiosyncrasies of Chimney Draft, by W. E. Crane.

Electric Power Distribution, by H. C, Spaulding.

Influence of the Steam Jackets of the Pawtucket Pumping Engine, by Wm. Kent.

A Combination Iron and Oak Pavement, by J. Wendell Cole.

Test of a Pulsometer, by De Volson Wood.

South Dakota is now engaged in raising $80,000 for its representation at the Expositions It proposes to erect a building 144 feet square.

The State Department at Washington, has been notified that Russia has appointed its royal World's Fair commission, and that the president of it is Privy Councillor Behr, Director of the Department of Finance.

Bids are soon to be invited for 450,000 square feet of sidewalks for the Exposition grounds. These walks, for the most part, will be forty feet wide. No restrictions are to be put on the bidders for the work. Every contractor will be allowed to bid on his own kind of work, and from all the different kinds of walks proposed what is thought to be the cheapest and best adapted to the purpose of the Exposition will be selected.

FEDERAL STREET AND PLEASANT VALLEY ELECTRIC RAILWAY, PITTSBURGH.

Recognizing the necessity of a perfectly reliable source of power, this company has spared no expense in fitting their power house with the best of steam and electric machinery. The building is absolutely fire-proof, with brick walls aud tile roofing.

The boilers are of the Hazleton type, rated at 1,000 h.p. in two units, and each furnished with three independent Roney stokers.

Four lines of railway are operated by the company and the current is furnished by: five 80-watt Edison dynamos; one 150-watt Edison dynamo, and three 40-watt Thomson-Houston dynamos.

In practice these two differently wound generators are not found to work well together, and in a short time the electric machinery will probably be exclusively Edisou.

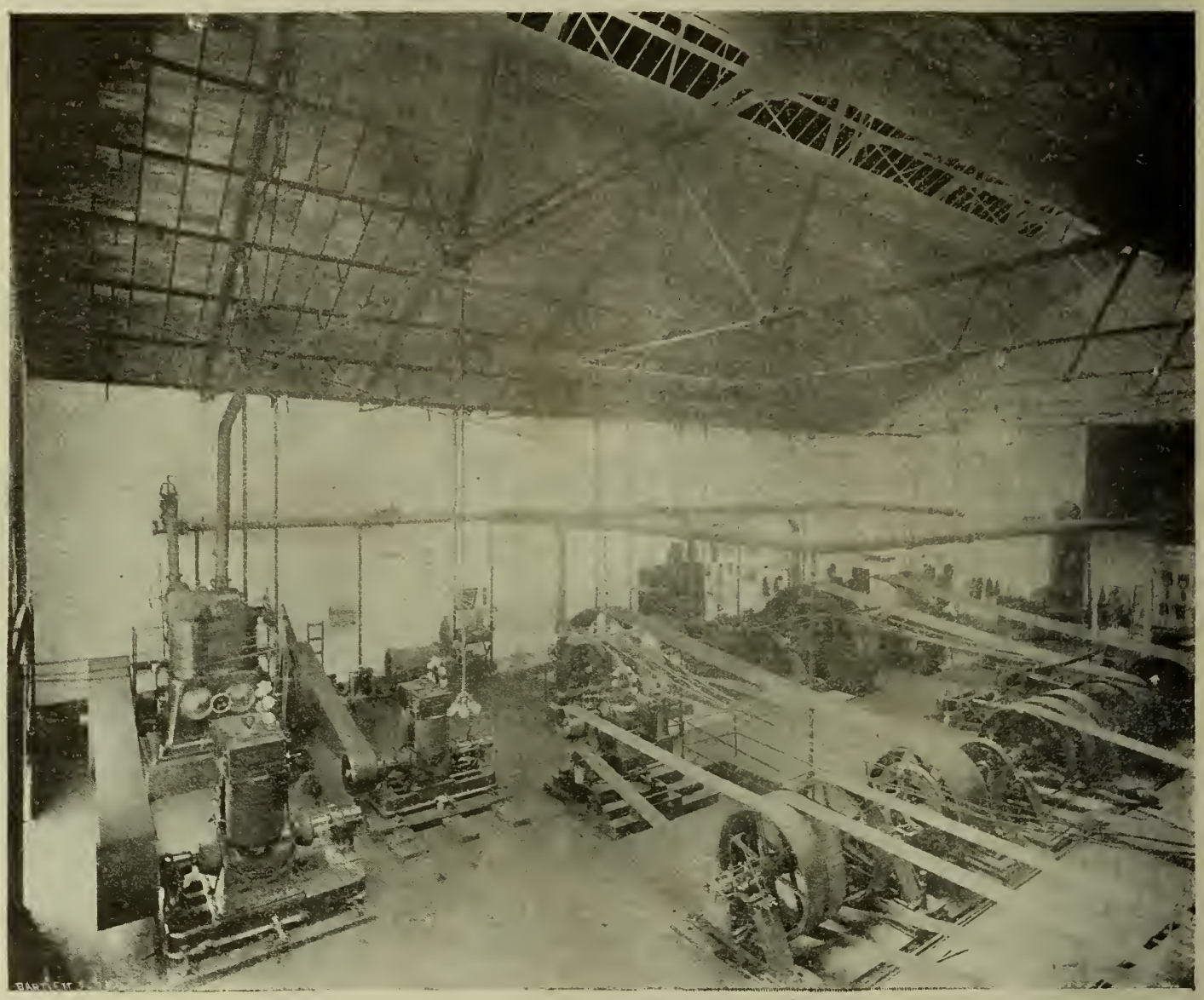
The power originally consisted of: one 18x33 and two 24x33 Buckeye engines, and with a view to guarding against possible delay through accident, a system of clutches and countershafting was adopted and so arranged that any engine might run any dynamo, or even take all the load. In spite of these precautions, they have had more than their share of trouble.

That they have beeu so unsuccessful in this respect has been the fault of the design of the plant, rather than carelessness in its operation or the policy of the purchasing agent.

Belts and clutches always seemed to slip when the load was heaviest, and the shaft bearings got hot when greater service was demanded and when a shut-down was most vexatious.

Finally, losing all patieuce, the company have installed an 18 and 30x16 Westinghouse high-duty compound engine, belted direct to a 150-watt Edison dyuamo, and intend to thoroughly test the combination by comparison. Its success seems to be already demonstrated to be as great as the failure of the system whose work it shares. It is quite probable that independent engines will eventually displace the centralized power with its expensive complication of shafting, clutches, belting ,etc.

The interior view of the station, (shown herewith) from a photograph, shows the disposition of the machinery and the contrast between the simplicity of the one plant and the intricate construction of the other.



Federal Street and Pleasant Valley Electric Street Railway Company, Allegheny and Pittsburgh, Pa.

The Department of Transportation is offered one of the most valuable relics of the early days of railroading in this country and will doubtless secure it for an exhibit. The old locomotive "Samson," built in England in "the thirties" by the celebrated Timothy Hackworth and brought to this country in 1838, is still in existence and in working order. Accompanying it is a quaint old passenger car built in imitation of a stage coach, both standing on some of the old scolloped or fish-belly rails. The engineer who first ran the locomotive is still alive, and if still liviug at the time of the World's Fair may accompany the venerable engine.

BOILER EXPLOSION IN KENTUCKY.

By a boiler explosion at Louisville, Ky., last Monday afternoon one man was killed, several persons injured, and nearly $500,000 worth of property destroyed.

At 5 o'clock William R. Adams, a fireman at the electric-light plant of the Louisville Gas company, was throwing coal in the furnace when one of the battery of seven boilers let go. The shock in the vicinity was like an earthquake. Adams was thrown to the ground with terrific force and received such internal injuries that he will die. The shed in which the boilers were located was demolished and pieces of iron aud timber and showers of red-hot coals were thrown in every direction. A great mass of iron and a deluge of burning coals were thrown across a narrow alley into the rear of Kaufman & Strauss' big retail dry goods store and the wall of the store was carried away. Half a dozen clerks were gathered about the bookkeeper at the back of the store. With the bookkeeper, Solomon Dreyfus, they were caught in the wreckage, but it is believed all escaped alive. Dreyfus was seriously injured. Carrie Dinkelspiel, Hattie Ennis, and Lena Sickles were slightly injured. At once the whole building was in flames, and as the wreckage and goods burned like tinder total destruction soon followed.

The fire was conveyed to the *Courier-Journal* and Polytechnic Library Buildings, which were saved with difficulty. The books, pictures, and other art collections in the latter were damaged by water.

The fire burned out the two upper floors of J. V. Escott & Sons, dealers in pictures, fine mirrors, wall paper, photographers' supplies, and the two lower floors were flooded with water till hardly anything was saved. Levrone's confectionery and Porter's millinery store were slightly damaged.

William Wilsher, engineer at the electric light boilers, was with Curt Dawson, dynamo tender, in a room adjoining the boilers, and they barely escaped. He says he had on only 100 pounds of steam, while he was allowed 120.

TOTAL STEAM POWER ON EARTH.

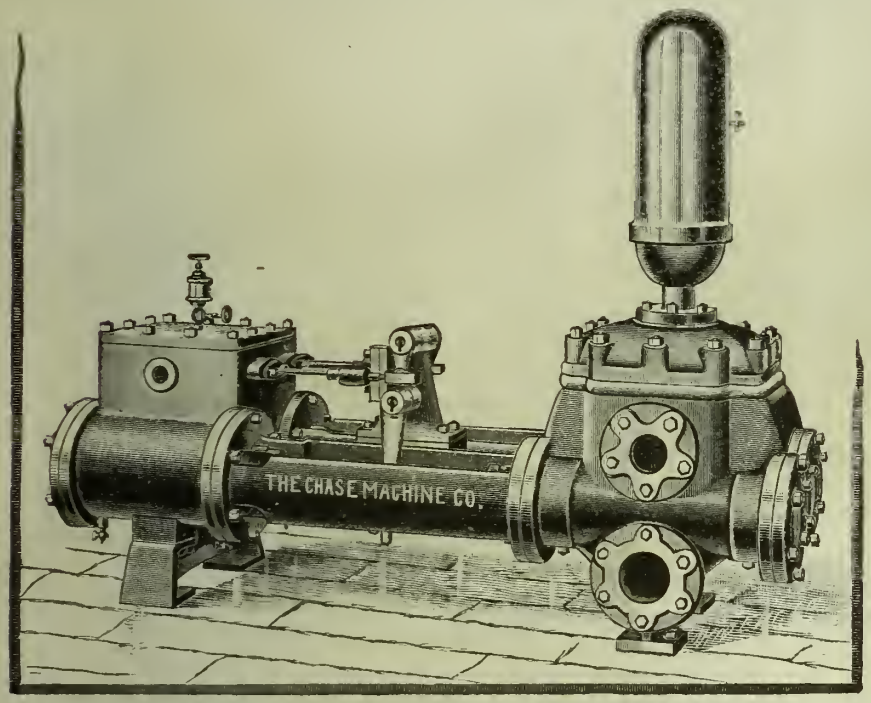
According to the *Leipziger Tageblatt*, four-fifths of the world's steam engines at present in operation have been constructed within the last quarter of a century. France possesses 47,590 stationary eugines, 7,000 locomotives, and 1,850 marine engines; Germany, 59,000 stationary engines and boilers, 10,000 locomotives, and 1,700 marine engines; Austria, only 12,000 stationary eugines, and 2,800 locomotives. The force of the steam engines in operation in the United States is equal to 7,500,000 horse-power, of those in England to 7,000,000 horse-power, in Germany to 4,500,000, in France to 3,000,000, and in Austria to 1,500,000 horse-power. In these figures the horse-power of locomotives is not included; in the beginning of 1890 the total number of world's locomotives amounted to 105,000, representing from 5,500,000 to 7,000,000 horse-power. Taking the figures as 6,000,000 only, this gives the total horse-power of the whole of the steam engines and locomotives on the earth as 49,000,000. The horse-power of a steam engine may be estimated as equivalent to the power of three horses, and the power of a horse as equivalent to that of seven men. The world's steam engines, therefore, represent the enormons total of 1,000,000,000 men, or double the number of workers in the world, the total population of the earth being estimated at 1,460,000,000 souls.

Dr. Bertolette, Commissioner to the La Platte Republics, has informed the Latin-American Department that he is endeavoring to secure for the Exposition a colony of lace makers and gold and silver workers from Paraguay. These people are ingenious, their product being equal to that of the Brussels working women, and the fact that they use vegetable fiber exclusively makes their work of even greater value and interest. It has beeu planned by the Latin-American Department to have a group of these lace makers on the Exhibition grouuds; also a group of workers on gold and silver filigree.

THE CHASE MACHINE COMPANY'S IMPROVED DUPLEX PUMP.

The accompanying cut represents the general design of an improved duplex boiler feed, fire, and elevator pump, brought out some time ago by the Chase Machine Company, of 111 Elm street, Cleveland, O.

These pumps are designed especially for marine service, or wherever pressure is required, and are necessarily very heavy and well built. The principle and design of these pumps are similar to the ordinary duplex Worthington pump, except that improvements have been made that have seemed best, and which experience had suggested.



Each water cylinder, in the pump herewith shown, is supplied with a cast brass removable liner, so fitted as to be easily removed, rebored, and returned to the cylinder again. The water pistons are of cast-iron so arranged as to be packed with any packing of proper size that may be preferred or required by the service to which it may be put. Valves are of cast brass or rubber as may be preferred. Valve seats are of cast brass, so fastened into place as to prevent their being loosened by the difference in expansion between the two metals of brass and cast-iron, or from an unusual pressure. All other details are intended to be made of material, and in such a way as to be best adapted and most convenient for a machine of this kind.

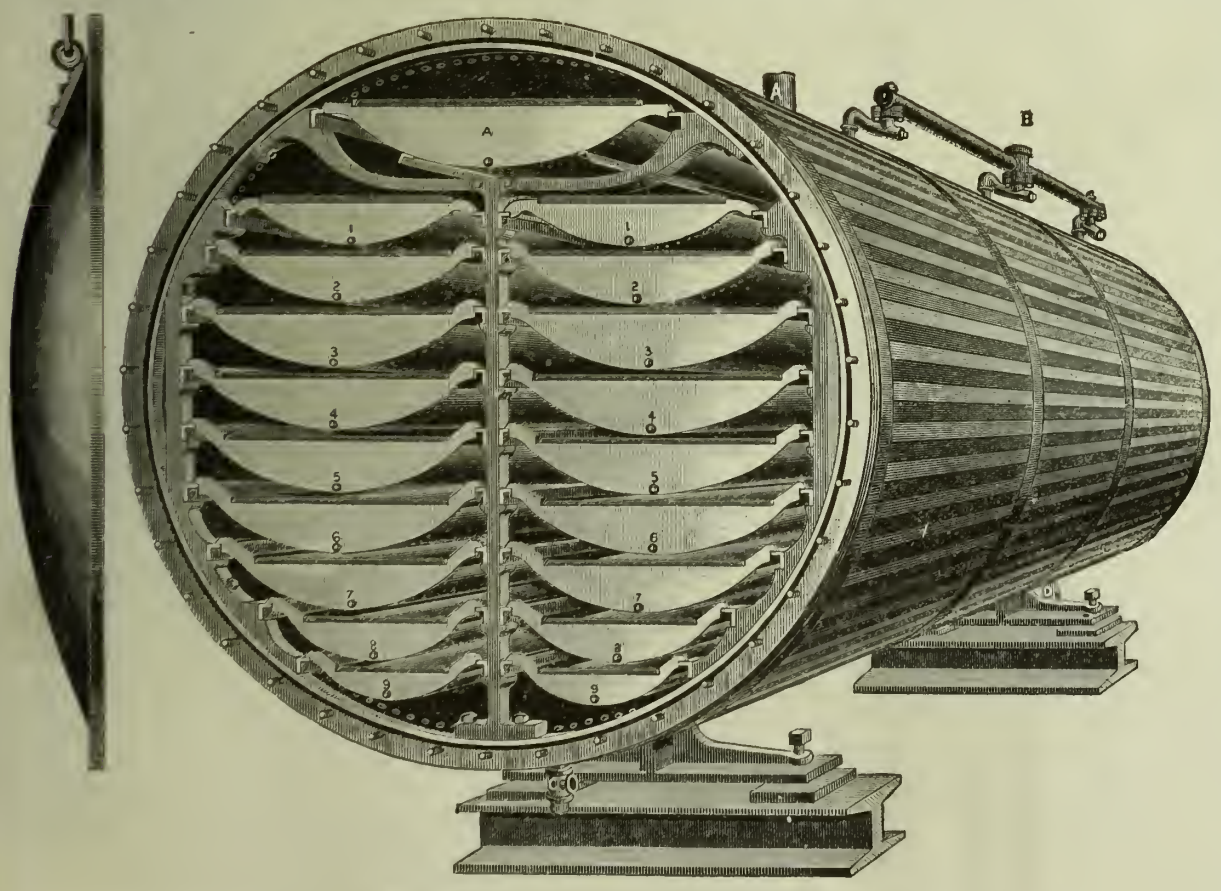
Besides the pumps here described, the Chase Machine Co. manufacture pumping and hydraulic machinery for other purposes. By addressing the manufacturers, as above, any desired information can be had regarding their pumps.

A 1,000 H. P. FEED-WATER PURIFIER.

The accompanying illustration shows a 1,000 h.p. live steam feed-water purifier, manufactured by the Hoppes Manufacturing Company, of Springfield, O. These machines are claimed to be the largest ones of this class ever built, and are sixty-eight inches in diameter by twenty-six feet long. They are built almost entirely of steel, the large removable heads being hot pressed from one sheet of best flange steel by hydraulic power.

This machine contains pans of the same form as are used in the smaller sizes of the Hoppes purifiers, but there are two tiers of pans in a section with a dividing pan at the top to receive and divide the water equally into each tier. Four sections of nineteen pans each are used in machines of this size, which affords ample surface to retain all scale making properties the feed-water may contain.

All parts are made of the best material, and the workmanship is first-class. As in the smaller purifiers of this kind, use is made of the under side of the pans to catch and retain the sulphates and silicates, the interior of the pans affording ample settling chambers for such solids as will precipitate. These purifiers are connected with the boilers by a large steam pipe, A, and the exit or gravity pipe, D, a blow off, is connected to the purifier at C. The pipe from the feed pump or boiler feeder is attached at B.



Hoppes 1,000 hp. Feed Water Purifier.

In operation the water is pumped in at B and, falling into the top pan, it overflows the sides and drops from the angle iron riveted to each side of the bottom into the top pans of the side tiers. When these pans are full, the water flows over the sides and, following the under surface, flows in a thin uniform sheet along the bottom until it reaches the center when it falls into the pan below, and so on over each successive pan until it reaches the bottom of the shell, from which it passes to the boilers through pipe D.

The water being thus heated to the boiler temperature parts with the scale making properties it contains, the greater part of which adheres to the under side of the pans. In this way are removed from the water the sulphates and silicates of lime and the sulphates of magnesia which will not precipitate, but which form on the bottom or under side of the pans on the same principle that stalactites are formed on the roofs of caves. The pans are made of light sheet steel, and are easily cleaned of all scale.

The Hoppes Manufacturing Company are prepared to build purifiers of larger sizes where they are desired, but prefer to use two or more machines in places where over 1,000 h. p. is required.

The company also build their large size exhaust steam feed-water heaters with pans arranged the same as in the purifier shown. These heaters are provided with oil catchers, automatic water regulators, and contain enough lime catching surface to retain all the solids liberated at the temperature of exhaust steam. These latter machines are built in sizes up to 3,000 h.p.

UNDERGROUND RAILWAY FOR NEW YORK.

The commissioners appointed to devise a scheme of rapid transit for New York City have recommended an underground system of railways in tunnels on each side of Manhattan Island from the Yonkers line to the Battery, and a cross-town tunnel under Union square. Express trains on special tracks to run forty miles an hour. Electricity to be the motive power and to light the tunnels. The block system to prevent accidents is proposed; and good ventilation, doing away with smoke, steam, and discomfort, will be provided.

There will be thirty miles of continuous road, or over 100 miles of single-track line if the commissioners' recommendation be carried out. The main line on the west side of the city, beginning at the Battery, will comprise four tracks and will extend as far north as the Yonkers line, about seventeen miles in all. This west side main line will connect with the east side at Union Square by means of a loop. The East Side main line will begin at the city hall and run due north a distance of thirteen miles. This will give seventeen miles of road on the West Side and thirteen on the East, or thirty miles in all exclusive of the loops and switches. There will be large stations at the Battery, at the city hall, at Union Square, and other central points. At intervals there will be switches and sidetracks in the tunnels for use in case of emergency. Two of the four tracks on each line will be used for express trains.

It will be stipulated that a speed of forty miles an hour must be maintained by all trains, exclusive of the stops at stations. Express trains will run from one end of the island and to the other in less time than it now requires to travel from the cityhall to Fourteenth street on the elevated roads. The tunnels will be at least 100 feet below the surface at the Battery, running a short distance under the park, but no part of the park will be encroached upon. As the tunnels progress towards the northern part of the city where there is less weight on the surface they will run nearer the surface. Beyond the limits of the city the roads will come to the surface and proceed to the northern termini on viaducts.

More than one and one-half million pounds of steel and iron will enter into the construction of Mines and Mining Building, at the World's Fair.

The Royal Agricultural and Commercial Society of British Guiana has decided to hold a local exhibition of its resources preliminary to the display it intends making at Chicago.

The American Engineer.

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CONTENTS OF THIS NUMBER.

ENGINEERS of Boston have a good opportunity open for them to hear lectures, such as they want to hear, from men of marked abilities, which are to be delivered free, in the Wells Memorial Institute, 987 Washington street, Boston, as appears from statement in another column. The lectures will be paid from the Lowell fund.

CORRESPONDENTS have something to say, and not wordy froth, in this and our last issue or two. It is a pleasure to answer all honest inquiries, as far as we can, and when engineers help one another, and endeavor to throw light on the difficulties of their profession, our correspondence columns will be beneficial and edifying to many.

ELECTRICITY seems likely to make a great step in advance, before long. Mr. Edison, as stated in another column, promises a motor, and current system, that will eclipse the present mode of railroad locomotion, as well as the electric railway systems now in vogue in several cities. His plan will do away with overhead wires, and with conduit systems, and all that, and the current will be "picked up" through mud and slush and deep water without trouble. Singularly enough a man described in a Denver paper as Edison's "rival" is said to have a scheme whereby the current is transmitted through wires without insulation, and buried in mud. It certainly looks as if electrical science is yet only in its infancy. And it is not safe for any one to venture to say what a day may not bring forth, in the electrical field.

RIVETING BY ELECTRICITY.

In response to inquiries concerning an electric riveting machine, described in one of our recent issues, we would say that such a machine is not yet on the market. It is not out of the experimental stage yet. The Thomson-Houston Electric Co. have such a machine in their experimental department at Lynn, Mass., we are informed.

Mr. Foree Bain, the well-known electrician of Chicago, says:

"I do not think there is a practical machine, to rivet by electricity, in the market. All of the experimenting, so far, has been in a direction toward utilizing the reciprocating motion of an electro magnet, which, in my opinion, is entirely impractical.

"To convert the rotary into the reciprocating motion for this purpose involves considerable complication that can hardly be tolerated in a machine subjected to the hardships that a riveting machine receives. We can not tell what a day may bring forth, however, and I would not say, by any means, that the electric riveting machine is an impossibility."

We are not at liberty, for the present, to publish what another electrician says on this subject,—except that he is confident that a practical electric riveting machine will be perfected in a short time.

From the indications we have observed, such a machine would fill an intensely-felt want.

WHO WILL BE THE WINNERS?

THE AMERICAN ENGINEER Publishing Co., with the view of bringing up the circulation of the paper to fully 20,000 copies each issue, offer a premium of $40 to the one who will send in the greatest number of new subscriptions, $20 to the one who will send the second greatest number, and $10 to the one who sends the third greatest number of new subscriptions, by January 1, 1892.

STRANGE MOVEMENTS OF A LOCOMOTIVE.

A curious story comes from Jacksonville, Ill., to the effect that late last Sunday night the watchman at the Jacksonville Southeastern line roundhouse saw one of their large locomotives cross the turntable, glide out upon the main track, and start down the road in the direction of Pisgah. On it went faster and faster without conductor or orders. The agent at Pisgah was wired to have the main track at that place cleared, and a north-bound freight had just been sidetracked when the headlight of the wild engine came into view within a hundred feet of the station, when it came to a standstill. Members of the freight train came near the engine when it stopped but saw no one leave it. The men at the roundhouse in Jacksonville saw no stranger about the place, yet when the runaway engine was boarded the cab was found to be vacant. The throttle was closed and the machinery was in perfect order. The circumstance afforded material for much discussion and room for many conjectures. There are railroad men who have heard of engines being run by supernatural agencies, and they are not prepared to say that a living being made the Sunday night trip. However, a strict watch is maintained at the shops there.

FREE LECTURES FOR ENGINEERS AND ELECTRICIANS.

The free lectures given by the Lowell fund will commence the first week in November, at the Wells Memorial Institute, 987 Washington street, Boston. These lectures will be thoroughly practical, designed to meet the needs of workingmen and mechanics, and include the following topics: Electricity, elementary; electricity, advanced; steam and the steam engine; sanitary engineering, and building construction. There will be fifteen lectures on each of the above topics. The lectures on electricity will be given on Friday evening of each week for the elementary lectures, and on Tuesday evenings for the advanced course. The lecturer is Prof. Wm. L. Puffer, of the Institute of Technology, and he will have at his command all necessary instruments and apparatus, a 1-horse power electric motor, the Edison circuit, the arc-light circuit, the alternating circuit, and a lantern for projections. None of the lectures will require a knowledge of mathematical subjects.

The lectures on steam and steam engine will be given by Thomas Hawley, editor steam department of the *Boston Journal of Commerce*, commencing Tuesday evening, November 3, and on each succeeding Tuesday evening. The lecturer will discuss the following topics: Merits and defects of different engine-valve systems and boilers; different methods of heating, direct and indirect; high and low-pressure steam, and exhaust; belts and belting; shafting; the testing of engines and boilers, and the practical use of the indicator.

The lectures on building construction and architectural drawing will be given by Prof. E. W. Smith, Tuesday evenings.

All of these lectures are free to every one, without any restriction other than to apply for tickets at the office of the Institute, on the evening of the lecture or before. Engineers, firemen, and those interested in electrical matters should attend these lectures. They will find them of great benefit.

A FATAL THRASHING ENGINE EXPLOSION

A fatal "thrashing accident" occurred at Mayville, North Dakota, on Thursday afternoon last week, at the big farm owned by Grandin Brothers. Four men were killed outright, and two others so seriously hurt that they died within an hour afterward.

The men were killed by the explosion of the boiler, due to the fact, it is claimed, that the engineer had allowed the water to run down too low. The machine had been standing still about two hours while some repairs were being made, and the explosion followed within two minutes after the engine started and the pump began pouring cold water into the boiler. Two of the killed were blown nearly to pieces.

The killed are: Hans Baastad, fireman; A. W. Blomers; Wm. Clark; M. N. Eisberger; engineer; A. L. Marsh, division foreman, and a man whese name is not known. Marsh leaves a wife and two children who live at Fargo.

Two men, Wm. Peabody and Larry May, were seriously injured, but are expected to recover.

A WONDERFUL STEAM ENGINE.

It was in 1874, I believe, that D. A. A. Buck, an ingenious mechanic of Worcester, Mass., constructed a perfect steam engine of such lilliputian dimensions as to gain for its maker the plaudits of the world. To go into exact details the boiler, pumps, governors, and all were so exceedingly small as to only occupy a space seven-sixteenths of an inch in diameter, or about the area of an old-fashioned silver 3-cent piece. It was only five-eights of an inch high, yet it contained 148 distinct parts, nearly all of which were silver and gold. It was held together by fifty-two screws, the smallest being but one one-hundredth of an inch in length. The engine had all the valves, gearing, etc., to be found on the ordinary horizontal engine. Three drops of water filled the boiler! The engine weighed but fifteen grains when clear of the base-plate. The diameter of the cylinder was but one-sixteenth of an inch; length of stroke, three-fifty-seconds of an inch.—*St. Louis Republic.*

The imitation battleship "Illinois," at the naval pier, in the Exposition grounds, is now rising from the water. Work is progressing satisfactorily on the hull. The deck will measure over all 348 by 69½ feet. This structure is to cost $100,000 and is the most original illustration of naval architecture ever worked out.

EDISON'S LATEST INVENTION

A commnnicatlon from New York, last Saturday, says:

Thomas A. Edison was seen at his office in Orange, N. J., to-day, regarding his newly perfected motor system for steam and street-car railroads. Asked if it will dispiace the steam locomotive he replied:

"Yes, it will dispiace steam if economy, as weli as speed and safety, is a factor of locomotion; not because it will make easily a speed of a hundred miles an hour, while steam strains itself to make sixty, bnt because it will get one horse-power out of from one to two pounds of cheap coal, while ont of six pounds of high price coal a locomotive can only get that same one horse-power. It will displace it because it will be cheaper."

"When will it displace it?"

"It will begin to do it between Chicago and Milwaukee at the World's Fair." Mr. Edison continued: "In pioneering you have to have a man with nerve to adopt yonr ideas. I have found the man. He is Henry Villard. It is his idea to have this system in operation between Chicago and Milwaukee during the Exposition. He intends to demonstrate that there need be no snch thing as waiting for trains between cities now considered a long distance apart. He intends to run a train, say, of two cars, every twenty minutes.

"I would not be surprised, after that to see him introduce the system over the whole of the Northern Pacific lines, though he would not be compelled to introduce it all at once and throw away all his locomotives. By this system electricity can be gradnally introduced, more trains being sandwiched in between the steam trains as the locomotive wears out."

Mr. Edison was disinclined to describe his inventlon. "I cannot go into details," he said, "for fear of injuring my rights on the other side—though, by the way, I never made anything out of European patents—bnt I will say briefly that the current will pass from the stationary engine to a central rail between the tracks, thence through the machinery attached to the bottom of the cars or motor. A freight-train, of course, wonld need a motor because of the nnmber of cars, although a single passenger-car could be run carrying its own motor beneath it, thence to the wheels, and thence back by the side rails to the power house or stationary engine. Three of these, with a horse-power of 10,000 or 12,000 each, would run the whole Pennsylvania railroad system between here and Philadelphia."

FAITH IN EDISON.

"In the conrse of a few years the locomotive of to-day will be but rarely seen," said General Superintendent Collins of the Chicago, Milwaukee & St. Paul road, in speaking of Inventor Edison's latest project in the electric-motor iine.

"Some experimenter will take np the new motor," said Mr. Collins, "and if it is bound to be a success the companies will be quick enongh to take it np for their own use, as every one is on the alert for progression and will gladly welcome anything new and practical, as I think this motor is."

Assistant General Manager Wood of the Chicago & Alton road thought the invention would revolutionize traffic bnt the cost it would save would be needed to keep the road-beds in repair.

"The higher rate of speed an engine travels," he said. "the heavier and more firm mnst the road-bed be. The expenses of constantly attending to the road-bed, the ballast, the rails and ties would abont cat up all that could be saved by lessening the running expenses. Mr. Edison has a great invention and the railroads of the country will eventually take it up but I think it will be some time before they do. There are so many engines in use and they represent such an enormous expenditnre of money that railroad companies will not be in too great haste to set them aside. Bnt as the old ones wear out the new motors will take their place."

The American Pomological Society, at its recent annual meeting in Washington, decided to make an Exposition exhibit classified by state and county associations, and also by individuals; and it appointed a World's Fair committee of six to confer with the Horticultural Department, and to perfect arrangements.

EDISON'S "RIVAL" IS ANNOUNCED.

The following tale is from a Denver paper:

Oregon has produced a rival to Thomas Edison, the world-famous electrician. He is F. J. Crouch, of Eugene, who has invented a harmless dynamo which a child can handle without fear of danger. Mr. Crouch was born in a log cabin near Oakland, Douglas county, in 1855. His father went from Baltimore to the Sandwich Islands in 1847 and then to California in 1849. His mother crossed the plains to Oregon in 1850. His father was captain of Company C, of Douglas county, in the Rogue River Indian war of 1855 and distinguished himself by many deeds of valor.

Mr. Crouch has lived at Eugene, off and on, for twelve years. When the Eugene Light Company was organized four years ago he became its electrician. Then and there he set to work to invent a harmless dynamo, one which would not require expensive insulation, nor entail danger to life. The dynamo now on exhibition at the exposition is the result of four long years of study and experiment. Upon it Mr. Crouch has spent every cent he has earned in four years, exclusive of the cost of providing for his family. His invention, rude as it is, represents an outlay of between $5,000 and $6,000. Mr. Crouch said yesterday that he was tempted several times to give up the work, bnt seeing that he had gone so far and spent so much money, he determined to hold up his end and win or lose. Once he adjusted things wrong, and received a shock which sent him spinning across the room.

Mr. Crouch says his machine is very simple, and adds that the secret of success is in the winding, induction and proportion of metals. There is another secret which he will not divulge. He says the success of his invention is in one wire but he does not desire to discuss the matter.

A feature of Mr. Crouch's exhibit is a 16-candle power light, burning in a jar of water, the naked wire being exposed to the water. Right above the jar is a light and an electric bell on the same circuit. A telegraph instrument has been worked a distance of three or four miles on the same line as an electric light without damage to either branch of the service. Again the incoming and outgoing wires of the dynamo have been run without insulation through mud and have then started lights without any loss of power. Mr. Crouch says his dynamo has the power of ten volts, while that invented by Edison has 110 volts. It will run fifty 16-candle power incandescents, with 4½-horse power including friction. In inventing it Mr. Crouch says he cast aside all the theories of construction of electrical machines and started on a new tack.

THOMAS A. EDISON'S REQUEST.

Thomas A. Edison asks for 35,000 square feet of space in the Electricity Building at the Columbian Exposition. In making this request Mr. Edison asks for exactly one-seventh of the ground floor space of the structure. He says if granted the space requested he will take pains to have every foot of it filled with an electric exhibit worthy of study. Prof. Barrett said he did not see how so much room could be given Mr. Edison.

A LOCOMOTIVE BOILER EXPLODES.

A despatch from Pottsville, Pa., says that at 6:45 o'clock on Monday evening a terrible accident occurred at Tucker's watch box, a short distance below St. Clair, in which three men were killed and one fatally injured. Mountain engine 195 on the Philadelphia & Reading railroad was drawing a train of empties up the grade when the boiler exploded, completely demolishing the engine, tearing up the tracks and doing great damage to telegraph lines and surroundings. The names of the killed are:

Charles Warnicker, brakeman, of St. Clair; Henry Wagner, engineer, of Port Carbon; Mahlon Keep, fireman, Charles Bauer, brakeman, of St. Clair, fatally injured. The men were in the engine cab when the explosion took place. No cause is assigned for the explosion, the engine being just out of the shops.

Chili feels quite chilly towards Uncle Sam.

HEADQUARTERS SUPREME CHIEF ENGINEER.

Syracuse, N. Y., Oct. 26, 1891.

To the Officers and Members, A. O. of S. E.:

Dear Brothers:—You are hereby notified that I have returned to this city, and will again make it my residence and headquarters. All communications should be addressed to me at 211 East Castle street, this city. My reason for this change will be given to the Order in a letter to each council.

Yours fraternally,
Jefferson Young, Jr., S. C. E.

M. COWLES DROPPED FROM THE ROLLS

Whereas Merrick Cowles has ceased to act as "manager" of The American Engineer, the official gan of the American Order of Steam Engineers, and

Whereas his life membership having expired on that date,

Therefore be it resolved that his name be dropped from the rolls of the Order.

By order of committee, Fort Dearborn Council, No. 6, Chicago, Ill.

W. C. Kelsey,
Cor. Engr.

ALASKA AS A PENAL SETTLEMENT.

An editorial writer in *The Chicago Graphic* says: In our own country a notable percentage of the brightest intellects are locked up in the penitentiaries. In most of the states the convict leasing system has been abolished and organized labor is urging an embargo against every form of prison labor. This would compel free labor to support criminals in idleness rather than require convict labor to help support the state. If the political demagogues comply with this absurd demand the only method of reforming criminals will be through the agency of penal colonies beyond the reach of competition with free labor. Probably the dread of transportation to the antipodes would have a deterrent effect on criminals and diminish the commission of crime. Penal colonization in Alaska might tend to its rapid settlement and enrichment by immigration, as at Botany Bay. If the result of the experiment corresponded with that in Australia, there would be a surprising development of the mineral resources of of Alaska, and descendants of the penal colonists—owners of gold bonanzas, and bedazzling in Alaska diamonds and sealskin suits—might eventuate as representatives, senators, governors and presidents of the United States.

BRINGING LAW INTO CONTEMPT.

Perhaps the school discipline which has been favored of recent years in large cities has much to do with the increase of juvenile offenders. Defiance of school law is followed by no adequate penalty and children then learn to disregard civil law. The utmost that can be done in the gravest cases of insubordination in the public schools is to deny the offender school privileges.

Any one can see at a glance how irrational such a method is. It would be as reasonable to set at liberty a criminal who refuses to obey the rules of a prison, as to turn into the streets idle and vicious children because they fail to conform to school discipline. Cruelty, it is true, begets vice, but justice is never cruel. A diseased moral nature often requires heroic treatment. Moral suasion may be efficacious, but moral suasion is ineffective when used by a person who is without great force of character, earnestness of purpose and personal magnetism, who has not an intimate and sympathetic knowledge of the subjects upon whom it is to be tried.

The public school teacher has an influence greater than that of the most eloquent preacher. By daily contact with the young minds there is affixed an indelible stamp. The discipline, too, of the public schools, is a matter of the greatest importance, and humanitarians, economists, city councils, the pulpit and press should combine to make it perfect, and to prevent that lapse into worse than savagery, the vicious life of the streets that is filling the jails of the country with young offenders, who there complete the education in crime so auspiciously began. —Olive Ohnet, in the *Chicago Graphic*.

NEW ENTERPRISES.

COLORADO.

The following items from Denver may be of interest; The steam plant of the Brown Palace hotel will consist of Heine boilers with a capacity to supply steam for developing 800 horse-power, and five Reynolds' Corliss engines; also ice machines, and 13 pumps (four of them compound). There will be five 800 incandescent light dynamos and a 250 arc light machine. Ottis and Hale will supply nine elevators. And there will be hydraulic and compression tanks, and Westinghouse air pumps. The engine room floor will be marble tile. And the plant is to cost $200,000. The chief engineer is a respected member of the A. O. of S. E., namely: Bro. A. W. Simonds, who is a competent man to fill the position. He is thoroughly posted on points of steam engineering, having followed the business all his life. We have several other plants being erected in Denver, of which I will give details later.

J. R. Price.

ILLINOIS.

The Cicero Town Board whose district is on the western border of the city of Chicago, have finally solved the question of lighting the town by accepting the proposition of the Cicero Water, Gas, and Electric Light company. This proposition is to light with electricity the territory bounded by Harlem, Austin, and Chicago avenue and Madison street. The price for twenty-candle power lights is to be $14 a year each and for thirty-candle power $18 a year. Outside of this territory, south of Madison street and north of Chicago avenue, gasoline lamps at $14 a year each are to be used, the company having the privilege of changing these lights for electricity at its option. The contract holds good for five years.

The committee to which was referred the matter of the Cicero and Proviso Electric railway extension have reported in favor of extending the ordinance for building the road on Twelfth street and Chicago avenue.

Foster Bros. of Fairbury have received a franchise to light the town. They are in the market for engines, boilers and dynamos.

Chicago.

The Cicero and Proviso Railroad Co. will erect a two-story work shop at Ridgland.

J. W. Ostrander, manufacturer of printing presses, will erect a seven-story and basement manufacturing building at 88-92 W. Jackson St. Cost, $35,000.

The Phoenix Carriage Co. will erect a three-story carriage factory 72x165 at 339 Wade St. Cost, $12,000.

S. M. Peterson will erect a four-story and basement molding factory at Union St., near Milwaukee Ave. Cost, $30,000.

A permit has been issued to M. C. Bullock M'f'g Co. to erect a one-story boiler house at 1170 Lake St.

A permit has been issued to Weir & Craig to erect a four-story foundry at 2421-2423 Wallace St.

A permit has been issued to M. D. Fraser to erect a five-story warehouse, with elevator, at 38-40 Monroe St.

The Secretary of State has issued charters to the following new corporations:

The Calumet White Lead and Color company, at Chicago; to manufacture white lead, paints, etc.; capital stock, $1,000,000; incorporators, W.J. Aiken, E. D. Scott and J. C. Packard.

The Prescott Naval and Military Diorama, at Chicago; to carry on an amusement business; capital stock, $500,000; incorporators, T. S. Prescott, Frank Lynch and E. M. Smith.

The Woman's Baking company, at Chicago; to do a general baking business; capital stock, $250,000; incorporators, Fanny H. Rastall, Caroline A. Huling and Lydia R. Bentley.

The Prescott Steam-Heating company, at Chicago; to manufacture car-heating apparatus; capital stock, $150,000; incorporators, C. C. Poole, A. H. Graves and G. A. Prescott.

The Jacobs Red-Stone Quarry company, at Chicago; capital stock, $100,000; incorporators, C. F. Jacobs, Herman Franken and Fred Simouze.

The Thayer and Britton company, at Chicago; to manufacture car and locomotive bearing and railroad supplies; capital stock, $100,000; incorporators, F. W. Thayer, F. H. Briton and Louis Danziger.

The Chicago Shoe company, at Chicago, capital stock, $25,000; incorporators, W. H. Payne, Perry Crosson and A. L. Allen.

Litchfield Paint and Color company, at Litchfield; capital stock, $5,000; incorporators, David Davis, Jr., C. J. Paullis, C. W. Beardsley, and others.

MICHIGAN.

The Belding Silk Mills will enlarge their plant at Belding.

Silas Kilbourne & Co,, of Grand Haven, are going to rebuild their plant on a larger scale, they having burned down some weeks ago. Their business is the manufacture of fish pails, boxes and barrels.

PENNSYLVANIA.

Philadelphia.

Since the Reading Railroad has started the new station at Twelfth and Filbert streets numerous projects have been set on foot to prepare for the entertainment of the travelers who will use this road. The latest hotel scheme is being developed by Preston J. Moore, the owner of the Windsor Hotel, on Filbert street, below Thirteenth. The property adjoining the hotel on the west has been secured from J. W. Wistar for $20,000. This building is to be torn down and a large addition to the hotel erected. The old building is to be entirely remodeled and enlarged and a new front will be put up, making the facade very imposing. Contracts will be awarded at once and operations started as quickly as possible.

The Northern branch of the Y. M. C. A. will erect a gymnasium building on Frankford avenue, below Norris street. This structure will be only temporary, and is to be used during the winter. In the spring a handsome building, to cost $50,000, will be erected, from plans by Hazlehurst & Huckle. William Steele & Sons have the contract for the temporary building.

A new brewhouse is to be built at Susquehanna avenue and Fairhill street, from plans by A. C. Wagner. The brewery is to be four stories high, and will be constructed by William Tecklenburg.

William Sellers & Co. will erect a large addition to their plant at Sixteenth and Buttonwood streets. The addition required is to be a flash shop adjoining the sandbins on the east side, with a pattern loft over the sandbins to the east end of the present foundry. A large traveling crane will also be built to facilitate the handling of material.

FROM THE EARTH TO THE MOON.

It does not seem improbable in the course of events that the earth and the moon may become more intimately acquainted. A few years ago scientists held the theory that the moon was a dead planet, without atmosphere and consequently uninhabited. This theory has recently been entirely controverted. The work begun by Professor Holden at the Lick observatory upon Mount Hamilton, has been steadily continued, and the photographs taken by him and his assistants have revealed certain facts hitherto unknown. Photographic observation show a perfect map of the moon, and upon the summit of one of the highest mountains is a white spot which has the appearance of a glacier, proving the presence of atmosphere and making the theory of the habitableness of the moon tenable. It is claimed by Professor Holden that by a continuous series of photographs he is able to detect any changes upon the surface of the moon, and that a building fifty feet in height would cast an appreciable shadow. If the moon is inhabited the fact will certainly be discovered sooner or later but the question of the establishment of communication is still unsolved, although in the face of scientific achievements of the last century we will not predict that it is unsolvable.—*The Chicago Graphic.*

LARGEST DRY DOCK ON THE GREAT LAKES.

For the past few years, the necessity of larger and better docking facilities on the Great Lakes has been very apparent, but the risk of construction and uncertainty of the business has kept many from the undertaking; the Detroit Dry Dock Co., however, about a year ago determined to build a dock larger and finer than anything yet attempted on fresh water. And after almost a year spent in its construction, we believe we have now just such a dock, together with every modern appliance to facilitate prompt and economical execution of all this class of work. It is situated in the City of Detroit, foot of Orleans street, where the offices, saw-mill, engine, boiler, and general repair yards of the Detroit Dry Dock Company have been located during the past forty years. The new dock, together with its surroundings, has presented a very busy scene, with everything being pushed to complete the undertaking as soon as possible.

Mr. A. J. Dupuis, the well-known contractor and builder, carried out the work in its entirety, under the supervision of Mr. J. C. Parker, superintendent of the Orleans street yard.

The soil at this point is fine blue clay, which has enabled the work to progress without interruption from landslides or leakage of water. Two thousand piles have been driven in the dock, making it as strong as it is possible to be. Loaded ships carrying a cargo of 3,000 tons can be safely docked, and those of the largest dimensions can be easily taken in.

The inside dimensions are, 378 feet long, 91 feet wide on top, 78 feet opening at entrance, 54 feet opening on mitre sill, 55 fect wide on floor, 16 feet 6 inches of water over keel blocks, 16 feet 6 inches of water over sill, 4 feet 6 inches from top of keel blocks to floor of dock, 20 feet 6 inches from water line to floor of dock.

The keel and bilge blocks are five feet from center to center, averaging 5 feet high, thus leaving plenty of room under a ship for the movements of workmen in making any necessary repairs to her bottom. There are two wells 12 feet deep situated at each end of the dock, with cranes above them for hoisting out and replacing wheels, etc. The caisson gate which, when closed, shuts off the ingress or egress of water, is of steel, constructed at the company's steel ship building plant at Wyandotte, Mich. It is 12 feet beam, 79 feet 5 inches long, with five 30 inch valves for flooding the dock, which it is estimated it will do in twenty minutes. Time required to pump the dock out is 1½ hours. The whole dock is surrounded with a puddling wall filled with blue clay 5 feet thick, and extending down below the old river bed, which completely shuts off all water from leaking through the sides.

The pumping plant, which is very complete, consists of two centrifugal pumps, with 30 inches discharge each. These are driven by two 150 h.p. independent compound Westinghouse engines. These pumps are in a well 22x11 feet inside and 35 feet deep, the water passing from the dock to the well through a brick tunnel 5½ feet diameter and 55 feet long. The steam for the engines is supplied by a battery of three boilers, 5½ feet in diameter and 15 feet 6 inches long, built by the Dry Dock Engine Works. The fuel is oil, and the whole pumping plant is housed in a two-story brick building 34x81 feet. A dynamo-room is provided, where an electric light plant will be put in during the coming winter, which will supply the entire ship-building plant with light. The second floor of the building will be utilized by the workmen at noon and other hours, when work may be temporarily suspended, and will be fitted up with an eye to their comfort.

This dock is large enough to take in any boat now upon the great lakes, and has been designed especially for the wide railway car ferries and passenger boats with their overhanging guards and paddle wheels.

The cost of this dock was upwards of $200,000. There has also been added to the Detroit Dry Dock Company's plant, a pair of steel shear legs, for hoisting boilers, engines, spars. etc., from and into boats. They are located just above the new dock, are 100 feet high, and have a lifting capacity of 100 tons.

CORRESPONDENCE.

What is the Trouble?

Editor, American Engineer:

I see in your issue of Oct. 17 a communication from "J. W." accompanied with indicator cards. I do not pretend to say at this time, what the tronble is with his Buckeye. But I am under the impression that the cards were taken with both ends of the cylinder open to the indicator piston at the same time.

If "J. W." will take a few cards from each end of the cylinder, and mark them properly, C for crank end and H for head end, I think the boys may be able to locate the tronble. C. P. W.

Those cards of 17th: I should say the rod donbles up, or there are loose joints; so the valve does not travel as it should; it also leaks. J. F. P.

About Triangles.

Editor, American Engineer:

Will yon kindly inform me whether an equilateral triangle is an isosceles triangle or not?

My definition of an equilateral triangle is one with the three sides eqnal; and of an isosceles triangle, bnt two sides eqnal.

I think an equilateral triangle cannot properly be called an isosceles triangle, and have backed my opinion with dollars, and will abide by your decision. Wm. Wilson.

[Bro. Wilson is right: an equilateral triangle has the three sides eqnal; but an isosceles triangle has only two sides eqnal.—Ed. A. E.

ADDRESSES WANTED.

George E. Gardiner, Frank H. Lewis, and Augustns Smearing, of Rochester Council, No. 8, N. Y., should notify us or their council of their present addresses, and then they will hear of something greatly to their advantage. Cor. Engr. John Aitken has something important to communicate to them.

FORWARD COUNCIL NO. 3, WISCONSIN.

No. 3, Forward Council, was instituted at Madison, Wis., last Saturday night, by S. C. E. Jefferson Yonng, Jr., with fourteen charter members. The following officers were installed:

Past chief engineer, G. E. Tanberg; Jr.ex-chief engineer, Ole M. Johnson; chief engineer, John A. Doyle; 1st assistant engineer, Peter Gower; corresponding and recording engineer, Bert Ainsworth; treasnrer engineer, Frank Alford; chaplain, John J. Longfield.

SILVER STATE COUNCIL.

Denver, Col., Oct. 21, 1891.

At the first regular meeting of Silver State Council, No. 1, A. O. S. E., Brother John Price in the chair, the following officers were elected for the ensuing term:

Chief engineer, Wm. A. Tyler.
Assistant chief engineer, A. W. Simons.
Recording engineer, E. H. Walker.
Corresponding engineer, H. G. Bumgartner.
Financial engineer, T. E. Obar.
Treasnrer engineer, A. B. Hensley.
Chaplain, J. F. Wood.
Senior M. M., James H. Dean.
Jnnior M. M., W. H. Morris.
Inside sentinel, Wm. Lockwood.
O utside sentinel, John J. Ray.

After which the meeting adjourned to meet Thursday evening, Oct. 27, 1891, for iustallation of officers. E. H. Walker,
Rec. Engr.

Pennsylvania's Exposition bnilding at the World's Fair, will cost $75,000.

The Western Union Telegraph Company intends to frame handsomely the first telegraph message ever sent, which was in May, 1844, and exhibit it in the Electrical Department at the Columbian Exposition. The message was received by Prof. Morse at the Capitol in Washington, from an assistant in Annapolis.

ENGINEERS.

There is no profession where the responsibillty is greater than it is in steam engineering, be it marine, locomotive or stationary. The proficient engineer is supposed to know every detail of his engine and boiler, and snccess depends entirely on his abilities; he must read and think, act with care and judgment. The very fact that he "thinks he knows" will not aid him in many of the difficulties he is liable to meet with.

It would be well for every engineer to think of the four great elements—force, time, motion and mass, and what they have accomplished, then apply them to himself.

Force: That amount of energy you have left to educate yourself and get to be proficient in your work, being valuable to yourself and employer; making independence out of what might be dependence.

Time: The amouut you can apply to obtain that ability and independence, which all mechanics should have. The value of time is great, and should be considered.

Motion: The accuracy and momentum which education can give to those bodies that civilization and progress owes much to—steam and its power.

Mass: The amount, volume and value that education can give the mechanic cannot be overestimated. It is priceless; it gives independence; it is something upon which to lean; it is a passport to all countries; it is easy to carry; you cannot be robbed of it; it cannot be sold or mortgaged. It makes a person know his services are always in demand and valuable.

Stephen Christie.

MISTAKE OF AN ENGINEER'S WIFE.

Charles Brown is an engineer on Long Island City, N. Y. He went to work as usual last Saturday morning. A few hours later his wife was told that the body of a drowned man resembling her husband had been found in New Town Creek, near Hunter's Point. She went where the body lay and identified it as that of Brown. When she recovered from the shock she ordered the body carried to her home. Crape was hung upon the door. At 7 o'clock that evening, while Mrs. Brown was weeping over the body of her husband, a step was heard, the door opened, and a man walked in. He saw the darkened room and wondered what had happened. "What does this mean?" he cried.

Mrs. Brown rushed from the chamber. As soon as she saw who the intruder was she fell fainting into his arms with the cry of "Thank God, my husband." When she recovered there was joy in the Brown household, despite the fact that the corpse of an unknown man lay dressed for the grave in the front parlor.

PATHETIC STORY OF THE FRONTIER.

The story of Mrs. U. J. Wenner's life on Fremont Island is about the most pathetic story ever told on the frontier, says the Salt Lake *Tribune*. She was born and bred in luxury; she came to this city a bride eleven years ago. When, five years ago, her husband decided to move to Fremont Island she cheerfully gave up her luxurious home in this city and went with him. Of course she had no neighbors. With no one but her husband and her little family around her, with a hired man and girl to assist she lived there five years. At one time she was there two years and a half without leaving the island. When, two years ago, her husband became too weak to ride on horseback she looked after the stock herself, she attended to her house, she taught her children, she nursed her husband, and in these occupations she was busy every moment of her time. She says she was happy, and we do not doubt it. Her husband was failing all the time, but he had been a long time ill, and she would not permit the thought of the possibility of his dying to enter her mind. So it went on until two weeks ago last Wednesday, when her husband had a severe hemorrhage of the lungs. It was stopped, and he said he felt more relieved than he had for months before. Of course great prostration always follows a hemorrhage of the lungs, and so he lay very weak but cheerful; Thursday he wanted the man who had been their faithful employe so long to take the boat, go over to Hooper and get the mail, as he said he wanted his papers and magazines. The man, however, did not go until Friday morning. Through the day Friday Judge Wenner was comparatively easy. He asked his wife to read to him from their favorite books, and also to repeat to him whole poems which she knew by heart, and so the day and night passed away. Saturday morning he told her what to cook for his breakfast, but while this was in preparation she heard the signal which she had prepared for him to make in case he needed her. When she got to his side the fatal hemorrhage was on his lips, and when she hastened to give him the medicine that was always given him at such a time he motioned it away. She put her arm around his neck, drew his head on her bosom, asked him if he loved her; he answered, "Yes," and asked her if she loved him; at her "yes" he smiled, and in an instant, without a spasm, that smile was transfixed and his soul had fled.

She was there all alone; with her own hands she washed and dressed her husband's body, went outside and got the board herself, and stretched it upon the chairs beside the bed; the girl had such a horror of death that she could not be induced to come into the room to help her lay her husband on the plank. She did it all alone, and when all was composed she went to her children, told them that their father was dead, explained to them as well as she could what death meant, took them in and showed them their father's face; they all kissed him, and knelt and prayed beside him. The day wore along, and a great storm came upon the lake so that it was impossible for the man to return. It had always been understood that two signal fires meant that she needed help, so as the night came down she went and lighted those fires and then took up her watch beside her dead. At intervals through the night she would go and replenish the fires, and so the watch went on till daylight. All that day passed away. At night she renewed the fires; and finally, at great peril, the man reached the island at 10 o'clock at night. There was no possibility to return to get a casket, so the poor woman told the man that he must from the boards on the place make the best box he could. The man helplessly said he could not, but she encouraged him and told him she would help him. So the box was made. From the best material she she had in the house she with her own hands lined the box and fixed a pillow for the sleeper's head. That completed, the man dug a grave. The only services for the dead were by the wife and little children kneeling around the coffin before it was moved from the house and praying. But then what other service was needed?

As best they could they got the box to the grave, the man drove stakes on one side of the grave and tied ropes to them, and that woman and that man lowered the body into the grave. Then she went back to take care of her children. The storm was so furious on the lake that it was a week before she could take her children and leave the island.

What she endured through that Saturday, that Saturday night, that Sunday, and that Sunday night no one knows, and no one can imagine. She did not shed a tear. She has not shed a tear since. She says calmly that she never anticipated life without her husband, but that now her childreu need what strength she has got. And she speaks of what she did as nothing at all. She says it was pleasure to her to do the last office; it is very much sweeter for her to think of than it would be to think that it was performed by some one who might have beeu less tender in his touch than she.

And that was by a little woman who never knew what work was or what isolation meant, who knew nothing at all about the rougher side of life until she gave her heart up to her husband and thenceforth lived only for him.

The Florida Horticultural Society has asked for three acres at the Exposition in which to show an orange grove and make a fruit display.

Indiana will have a $100,000 building at the Fair. It will not cost that much, however, as a large share of the material, all of which will come from that state, will be donated.

THE WOMEN'S DEPARTMENT.

WOMEN WHO HUSTLE.

Instances of women's "progressiveness are shown in the New York *Sun's* report of the Oklahoma rush, as follows:

The opening of Oklahoma and the grand rush for the Indian lands have brought fair woman before the public in a new character—that of woman boomer—and as such she is said to be braver and more daring even than the man adventurer. One of the most famous of these women is Nannetta Daisy, a finely educated and beautiful woman of 30, who was the leader of a score or more of women boomers having their headquarters in Indian Territory. Nannetta had been a school teacher and a newspaper writer, and missed by but one vote being State Librarian of Kentucky. At the head of her Amazon company of boomers she took up a claim near Edmunds, one of the best in the country. This claim was contested by a railroad engineer, the contest terminating in a shooting match. Both were slightly wounded, but public opinion was in favor of the woman. A squatter jury placed her in possession and warned the man to leave the country.

Catherine Labourier of Dallas, a modern Lucretia Borgia in temper and known as Sorrel Kate from her red hair and her custom of riding a sorrel horse, is another famous boomer. She shot a "tenderfoot" for too much familiarity, and no man dared molest the claims of the "red-headed terror from Texas."

Pretty Pearl Younger, the daring daughter of notorious Belle Starr, is a beautiful vision to be met at the boomer camps, dressed in light-colored corduroy pantaloons, with a neglige shirt, open at the throat, a white sombrero on her head, and a collection of pistols in her belt. She killed a man in defense of her honor and her property, and the rough boomers formed a phalanx about her through which no officer dared break. She is the wife of a man who worships her now, and she was the most popular girl in Oklahoma.

Miss Nellie Bruce, too, located her claim, built a home, or rather dug one out in the side of a hill on the site where her father's house had been burned by Indian scouts, and, surrounded by a couple of dogs and a flock of chickens, she held her ground alone against the enemy until recently, when she surrendered to the Mayor of Oklahoma and became his wife.

In all that pertains to womanly honor and virtue these women adventurers are above reproach, defending themselves at the point of the knife or muzzle of the pistol in the rare case when men's customary chivalry fails.—*New York Sun.*

WOMEN WHIPPERS.

A newspaper telegram from Mascoutah, Ill., Oct. 27, says that two weeks ago Peter Weingarter, a farm laborer 60 years old, procured a marriage license at Belleville to marry Miss Emma Hoenth, the daughter of a wealthy farmer. The license was returned to the County Clerk. Weingarter procured the license to marry Miss Hoenth without her knowledge, and when she learned of the matter she procured a large horsewhip and gave her aged and somewhat peculiar suitor a sound thrashing. She afterwards took the license away from him and had it returned to the County Clerk with the inscription "Not Wanted." Weingarter has left the neighborhood. He was once a wealthy farmer in an adjoining county, but lost all of his property several years ago.

A telegram from Appleton, Wis,, on the same date, says: Mrs. William Hyland was found guilty to-day of assault and battery upon H. D. Wing, editor of the Kaukauna *Sun.* Wing criticised her husband, who was Street Commissioner, and Mrs. Hyland took a blacksnake whip and publicly chastised him.

A QUEEN IN PEASANT COSTUME.

When Queen Margaret of Italy goes upon her climbing tours through the mountains of Gressoney she adopts the costume of the mountain peasants, which consists of stout boots, a short red skirt, and a black bodice. This rustic attire suits to perfection her striking beauty, and it is no wonder that the simple country people worship her. The Queen is an indefatigable walker, and her love for this exercise is of great amusement to her attendants. "Why, I assure you," said one of them the other day, "that her Majesty actually climbed up a rock with her hands when all the time she might have got round by a path."

NO HOME WITHOUT A WOMAN IN IT.

Every young man to have a home must have a wife. He can never substitute a boarding-place, a club, or a hotel for a home. This is to go through life hanging upon the skirts of life, leading a joyless, selfish, unnatural, and unpatriotic existence. God putteth the solitary in families. It is the best provision he can make for their usefulness and welfare. This divine arrangement cannot be set aside, or improved upon, or written down as a "failure." Young men and women art still to marry, build homes, rear families, plant gardens, and eat the fruit of them, marry when young, even though poor, join hands and hearts, and climb the hill together; they will reach the summit all the more surely and quickly.—*New England Magazine.*

THE ESCORTED GIRL.

These are the days when the escorted girl is prevalent. You can tell her at a glance, says the Boston *Gazette.* The girl whose brother is accustomed to take her about has an air of good fellowship which is unmistakeable. She is as much at home when being taken for a ride in an open street car by said brothers, or when accepting or sharing a theater treat, as if she were a boy or the brothers were girl friends. But the escorted girl is a study which is most amusing. She is of many kinds, but the general air of being escorted is alike in all varieties. You meet her in the street. There is a self-consciousness about her which attracts your attention at once to the fact that she is accompanied by a young man, for there is nothing which holds its italicizing so long as this. You see her in the open cars bound for a ride and bearing all over herself the imprint of having been invited. You watch her at the play. It is almost as interesting as the play itself—especially if the play is an old one. And nowhere do you see more of her than at church, especially at the vespers. All women do not, of course, belong to that class. The escorted girl has the conscious air of having just discovered that she is desirable, but not having yet learned for a certainty that she is worth while. She has the consciousness of suspecting that man is her natural prey, but of not being certain that she will get the chance to devour him. She feels her power, but does not quite know how to use it. She tries it, but with a slightly timid manner. She has not yet gained confidence. There is usually an open attempt to please in her manner which draws marked attention to her. It is while she is in this state that she gives away more of her real nature than she ever does later. And while she is in this frame of mind she comes under the head of the sort of girl I had been noting lately, and for lack of a better classification have dubbed the "escorted girl." There are women, I find, who never get beyond this stage. They are girls of suggestive possibilities who never realize all that they promise, for some indefinable reason. They never grow sure of their rights, never wear them with authority. This class of women is not uncommon. I recollect them in my youth. One often made great efforts to be made acquainted with them, and I never g > any further. They are often prettier than less active girls, but lacking reality they are only inspiring to the imagination. Femininity is hard to classify, however, and there is as much difference of opinion about it as about religion.

AT VASSAR.

Penelope—"Every tongue in college was wagging yesterday. You ought to have been here."

Cousin Dick (in a tremor of curiosity)—"What over?"

Penelope (quietly)—"Gum."—*Judge.*

DELIBERATELY CHOSE A CHINAMAN.

Gertrude Matthews, who married the Chinaman, Lee Po, recently, is a slender, graceful girl, with an intelligent face framed in pale golden hair. She is not more than 20 years of age, the child of wealthy and cultured parents, and a graduate of the Ursuline Convent. Owing to the death of her mother and the advent of a tyrannical stepmother, she left her home and became a governess in the family where Lee Po was cook. Here the romance was enacted which terminated in her marriage with the Chinaman. She had many other offers of marriage but refused them all for the Mongolian, who is so fond of his Caucasian wife and so jealous that he will allow no Chinese to speak to her except upon matters of business. To occupy her time Mrs. Lee Po has a class of Chinamen to whom she teaches English, and in the day time she attends to her household duties and operates a telegraph instrument. Her only woman companion is that of a half-breed Chinese woman, to whom she has taught the rudiments of telegraphy and with whom she talks over a wire stretched between the two places. She insists that her husband is kinder and more indulgent than a white man, and she cannot see why her marriage should concern the world so much more than the marriages of other women.

LOOKING AHEAD.

The month of October is, to the house-mother, more fitting to be called the first of the year, rather than the rightful owner of the name, inasmuch as therein is planned all the winter's work and play as well, while in January everybody has settled down to business with little thought of change until the skies clear and the thermometer rises.

In October the winter wardrobe is well gotten under way, the list of Christmas gifts is prepared, and the sociables and clubs are planned that shall enliven the long winter days and nights.

It is of the outside of the home that we would speak just now, and not of the economies or extravagances that must or need not be the ruler of the woman's kingdom.

First of all, oh, mother, make this resolve for your new year---glorious October: That creature comforts shall not make up the sum of your existence.

True, the children must have this or that for body and soul, but your body and soul must not grow faint and weary, nor must they be offered up a "living sacrifice" for their sakes. You must keep up with the times and keep young, else you cannot appreciate or help them to grow, and you will be outstripped in these bustling times if you do not give some thought to yourself.

The girls and boys are as proud of bright, active parents as the parents can ever be of the children over which their hearts rejoice or sorrow. Remember that!

In these days of books and newspapers there is always this outside aid to enliven even the most remote place, and every first-class book is within your means if you will think so.

Then, if you have a "buried talent," a ready pencil or brush that used to create beautiful things, get it out and with Mamie or Katie share the lessons you have thought best to engage for her.

Or, open your old music books, and if you can do no more, look up the waltzes and quadrilles, so that you can help the children to these dances, as well as to the Virginia reel, which all can dance, and "Going to Jerusalem" for the little ones.

Resolve to improve yourself a bit at the same time, and not only pick up the old threads, but weave a little new piece of cord for yourself.

You can have a literary circle among your intimate friends that is not impressively instructive, but is genuinely entertaining. Take the poets and essayists, first one then the other, and have one of your party prepare a brief sketch upon his life, while the others are ready with selections and quotations to be read aloud. Last winter, only six ladies met every two weeks at their various homes in this manner, and passed the hours from three until six in the afternoon with Jean Ingelow, Ruskin, Mrs. Browning, Carlyle, Thomas Moore, George Eliot, Burns and Charles Lamb. At six, the gentlemen came, directly from business, and the twelve

had a supper together which consisted of a substantial tea, which in no case was an elaborate repast.

The whole affair was neither expensive nor very troublesome, and proved a profitable and pleasing diversion. Just try it.

And lastly, for the sake of the little ones whose homes are not like yours, who have no mothers or worse than none, organize a sewing class, or a cooking class, that you may have a hand in helping the world grow a little better. If you have never tried work "among the least of these," you do not know the best of living, the pleasure of their eager learning, and the joy of making a little light in a dark place. Think about it and you will do it---but don't think too long.---M. D. M. in *Ladies' World*.

TRAGEDY OF AN ELOPEMENT.

(Time, midnight. Place, the shady side of the Billus dwelling. Ladder against side of house. Ardent youth half-way up ladder. Palpitating maiden leaning out of upper window, conversing in agitated whispers with ardent youth. Horses and closed carriage in charge of discreet driver at convenient distance round the corner. Moon disappearing behind friendly cloud. Coast clear. Landscape wrapped in repose. Billus mansion similarly wrapped.)

Bessie Billus---"'Sh, Arthur! Not so loud! Is everything ready?"

Arthur Chugwater (burning with lover-like zeal, but unable to keep his teeth from chattering)—"Everything is—b-b-b-b—ready, dearest! B-b-b-b—come, Bessie! It's ch-ch-ch-chilly, and—"

"O, Arthur, I'm afraid!"

"Afraid, d-d-darling? You can't fall. I'll catch you."

"'Sh! I don't mean I'm afraid of falling, Arthur, but suppose papa should—"

"Isn't—b-b-b—papa asleep by this time?"

"Yes; I'm sure he's asleep, but suppose he should wake up!"

"Is he—g-g-g—in the habit of waking up at unseemly hours of the night?"

"O dear, no! But I—I'm so—"

(Impatiently) "So am I—f-f-f—dearest, and it's getting colder every minute."

(Leaning a little further out) "Are you sure, Arthur, you love me as well as ever?"

(Impetuously) "Love you, Bessie? Why—b-b-b-b Great Scott! I—"

"'Sh! Don't whisper so loud, Arthur! Have you got the license?"

"We don't need a—ch-ch-ch—license to get married in Wisconsin. Got your wraps all on Bessie?"

"Yes."

"I haven't! I—b-b-b—left my overcoat in the carriage and it's getting—"

(Uneasily) "O Arthur! I've just happened to think!"

"What is it, dearest?"

"Suppose we shouldn't find a minister after we get across the line!"

"Not find a minister? Suffering Moses! Wisconsin is full of preachers!"

"And suppose—hark!"

"What is it?"

"I fancied I heard something!"

"It's—b-b-b-b—one of the horses whinnying. Hurry, dearest! The train leaves in half an hour and it will take us nearly twenty minutes to—"

"But, Arthur, I'm afraid it isn't right!"

"Bessie, see here—"

"It will just break papa's heart! I know it will! You'll always be good to me, will you, Arthur?"

"Be—ch-ch—good to you? So help me—"

"'Sh! Arthur! Don't swear!"

"Hurry, Bessie, for the love of—"

(Venturing out on the ladder) "Well, Arthur, I'm coming. But remember—"

(Assisting her down the ladder) "O yes, I'll remember! Careful now! Steady! There! We're down."

(Clutching his arm wildly) "O, dear! I feel as if I must go back! Where--where did you say the carriage was? It will break papa's heart and mama will faint! I know she will!"

(Recklessly) "Let her faint! Come, darling--b-b-b—it's only a short walk to the carriage."

(Wildly) "Must I go! Must I break the heart of an indulgent father and blight the life of a tender mother? Must I leave this cherished home where I have always been—"

"Come, darling!"

"Where I have always been--"

Papa Billus (thrusting his head out of the upper back window and speaking in a cold, hard, business-like voice)—"Don't forget your trunk, Bessie."—*Chicago Tribune.*

A DUDE OF A "LADY" SQUEEZED TO DEATH.

A telegram from Pottsville, Pa., last Sunday says: Tight lacing killed Katie Cole, a girl of 18 years. She was on her way to church and dropped dead in Franklin street after a slight coughing spell. Dr. C. A. Yocum was called, but Miss Cole was past his help An examination thoroughly convinced the physician that the tight compression of the closely-laced and slender waist had squeezed the life out of Katie.

A Brave Blacksmith Woman.

Miss Frances Cunningham, of Memphis, Tenn., owns and manages a smithy and wagon manufacturing and repair shop. She can do anything from lifting up a horse's foot and nailing on a shoe to putting together the newly manufactured parts of a carriage, road-cart, or wagon, says the *Chicago Tribune*. The history of the young woman is an interesting one, and one which should stimulate the courage of many another poor girl who finds herself suddenly left on the world, not only dependent upon her own resources for self-support, but with a family depending upon her for all the necessaries and comforts of life.

Five or six years ago Miss Cunningham's father, manufacturer of the "Cunningham wagons," much used throughout the South, died at his home in Memphis, leaving a widow with two sons and three daughters to mourn his loss. For a number of years before his death fortune had not been kind to Mr. Cunningham. Reverses beset him on every side, and he found himself when he came to die several thousand dollars in debt. Being a man of much pride and of honest principles he chafed under this indebtedness. It seemed the strongest regret of his deathbed that he should leave his finances in such an embarrassing condition. His last request was that his eldest unmarried daughter, Frances, should clear his name from debt. Strange that the father should have faith that one of his children, and that, too, a daughter who had had no training whatever for business and reared in the South, where women are educated to be more dependent than in any other part of our country, might be able to do what he had not done, that she could lift an indebtedness which he could not avoid contracting, but he did have such faith, and, on the promise of Frances that she would devote her life to clearing her father's name from the stain of debt, he died contented. The widow, as the daughter expresses it, "did not know the least thing about business." The boys were yet too young to be depended upon.

At the time of the father's death the creditors wished to take the wagon-shop and business for what it was worth, feeling sure that they could hope for nothing beyond that. The friends of the family urged them to let it go, as there was none of them who knew anything about the business or could make anything out of it if they did. The mother willingly yielded to their persuasions, but Frances, against the will of her mother and the opposition of all her friends, steadily refused to give up the business, stoutly maintaining that she could run it and she would. She had promised her father that she would pay off his debts and she meant to do it. And she did it. Her father's faith has been rewarded, and every dollar of the debt which he left his family as an heritage has been paid.

Miss Cunningham has made herself so familiar with all the details of the business that she has won the esteem and confidence of the entire community in which she lives. She is not afraid to lift up a horse's foot and nail on a shoe, and there is nothing connected with the mechanism of a wagon that she is not familiar with. She does all her own buying, and selects the various kinds and qualities of iron and steel and wood used in the business with as much skill and wisdom as a man.

Miss Cunningham was one of the victims of A. P. T. Elder's scheme. She was brought to Chicago under false representations and delusive promises of this man to make her his general agent for the South to establish an office in Memphis and pay her $75 per month to manage the office. Mr. Elder would not accept a $5^0,000 bond which the bright young woman could have given him right at her home, but demanded a $300 cash deposit as a security for her honesty and integrity in the handling of thousands of dollars of his money in the future.

Miss Cunningham was sagacious enough to be a little bit suspicious of this manner of doing business and, although everything seemed all right and Mr. Elder talked smoothly and had a mien devout enough for a country clergyman, still there was such a well defined doubt in her mind that she determined not to give him the cash which she had prepared herself to do, but instead give him a check on her home bank, knowing that would allow her two days' time to investigate Mr. Elder. She at once set about making inquiries and learned enough to satisfy herself that a fraud was possible, when she telegraphed her home bank to stop payment on the check, thus saving herself the loss of $300. The next morning after sending this telegram she read in the *Tribune* of the arrest of Mr. Elder and a full exposure of his scheme.

The young woman went home congratulating herself that she had lost no more than her expenses to and from Chicago, which Mr. Elder promised to pay, but of course did not pay. He did not even suggest, when she gave him her check, to make it for $300 less the traveling expenses which he had agreed to pay. She, however, was much chagrined over the adventure.

"I had come to be quite proud of myself," said she, "and believed I had some real business capacity, but to be so taken in, if you will pardon the expression, quite takes the conceit out of me. I shall go back home now and continue to shoe horses and make wagons in the good old-fashioned way, and shall put aside all these fairy thoughts of $75 salaries for merely keeping open an office for agents' supplies. O, you wicked Chicago people, you would deceive the very elect."

A Negro Woman who Held Slaves.

Louisville *Courier-Journal* says: The Filson club held its first meeting since the summer vacation last evening at the home of Col. R. T. Durrett. Miss Ida Symmes read a paper on one "Aunt Eliza," a colored woman who had been a large slaveholder up to the time of emancipation. The life of the old woman was delightfully told and many humorous scenes in the darky's plantation life were well brought out. The subject of Miss Symmes' historic sketch lived the greater portion of her life on the Newburg road in the vicinity of the "Wet Woods," where she died in 1887. She herself was a slave until the year 1833, when she was given her freedom by her master, John Hunley. Upon Mr. Hunley's death, a few years later, she came into a considerable portion of his property, a part of which was an old two-story log cabin near the "Wet Woods," which at that time was the handsomest dwelling in the neighborhood. Her chief ambition from the moment of her freedom, it seemed, was to become a slave-owner and a lady.

She set about getting slaves any way she could, but her usual method was to buy children. At the beginning of the war she owned forty-five of her own race. According to a special statute, no negro was allowed to hold slaves, and to avoid any violation of the letter of the law all the property of Aunt Eliza, including the slaves, was held by Mr. James Guthrie, the eminent financier, in trust. In this deed of trust to James Guthrie appears the name of a female slave who had cost $600, a man for whom she had paid $400, a half-grown girl for whom she gave $375, and a number of small boys who cost her $100 each.

While never cruel, it seems Aunt Eliza never allowed her slaves to stop work except to sleep or eat. Her farm, consisting of forty acres, was kept up by slave labor. The old woman herself never did anything, and it was her custom, when rebuked for idleness, to say that there was no need for her

to labor, as she owned enough men to work for her. She owned several carriages, and always went attended by a footman.

The old woman was married three times, and once to a slave. As she did not buy him from his owner he took the first opportunity to run off to Canada. She never owned any of her husbands, and would never use any of their money. At the death of her second husband she refused to accept the property he had left, and distributed it among his kin. From the account given of her by Miss Symmes, who knew her intimately, Aunt Eliza must have been a strange creature. At her death she willed her house and farm to the woman whom she had bought for $600, and who was, according to the deed of trust, the most valuable piece of property she had ever owned.

Successfull Woman Deer-Stalker.

One of the largest deer killed in the Adirondacks this season was shot last Sunday by Mrs. Albert Aiken of Cohoes, N. D.

Mrs. Aiken, accompanied by her husband, was stationed on a "runway" at Lewis lake. She had a 32-caliber rifle weighing but 5½ pounds. She had been stationed on the "runway" about an hour when she sighted a large buck in the lake. Taking careful aim she pulled the trigger. The shot was true, the bullet going through the head. In less than an hour from the killing of the first buck the woman brought down a second one. The first buck weighed 235 pounds.

TO REMOVE MILDEW.

Moisten the spots, and rub well with soap, then scrape some chalk very fine, and rub that in also; lay in the sun wetting the goods from time to time. Take equal parts of lemon juice, salt, starch and soft soap; rub on thickly and lay on the grass in the hot sun. Renew the application two or three times a day.

A Birmingham (Ala.) girl 5 years old weighs 100 pounds. She is 43 inches tall and measures 43 inches around the waist.

LITERARY NOTES.

There has been no book written on Hawaii, or the Sandwich Islands, as many still call them, within the last twenty years. But the silence will soon be broken by Mrs. Helen Mather, who has written an account of "One Summer in Hawaii," which the Cassell Publishing Company will publish Mrs. Mather's style is simple and unconventional, just the right touch for a book of this sort, and it will undoubtedly turn the attention of many travelers toward this little group of islands in the Pacific. The book will be beautifully printed and illustrated from photographs and drawings made by Walter McDougall, who has had the pleasure of spending part of the summer in Hawaii. The graceful cover design was made by the author of the work, which accounts for its appropriateness. Mrs. Mather is fortunate in bringing out her book just at a time when more than usual attention is being attracted to Hawaii.

"The Anarchists: A Picture of Civilization at the close of the Nineteenth Century," is the title of a new German work an English translation of which will shortly be published by Mr. Benj. R. Tucker, of Boston. Mr. Tucker is a personal friend of the author, John Henry Mackay, who stands in the front rank of the young German realists. Mackay traces in this book, under the veil of fiction, his own mental development, or degeneration, to his present position,—that of a philosophical and egotistic Anarchist. The scene is laid in London, and the riots of Trafalgar Square, the misery of the East End, and the Chicago executions are graphically pictured in panoramic succession.

Mr. Benj. R. Tucker, of Boston, has in press a volume of "Holiday Stories," by Stephen Fiske, the well-known dramatic critic and litterateur. The book will be ready early in November, both in cloth and in paper.

The National Hot Water Heater Co., Canton, O., have issued a novel card. It represents a door on its hinges, with the inviting inscription "The latch string is always out—pull it." When the string (on the oard) is pulled, the door opens, and behold, an illustration of the heater appears, with the firm's announcement. The fact that the "ad" is under the "latch string" whets the mind with inquisitiveness.

BUSINESS NEWS.

BEST CHUCKS IN THE MARKET.

(Copy.)

REMINGTON STANDARD TYPEWRITER MFG. CO.

ILION, N. Y., Jan. 21st, 1891.

Oneida Mfg. Chuck Co., Oneida, N. Y.

GENTLEMEN:—

We have delayed answering your favor of the 6th inst. until we could get the chucks fitted to lathes and have a trial of them. Having now done so, we are pleased to report that we are well satisfied, and believe them to be among the very best chucks in the market, and a superior article for the purpose of holding pieces of wire for turning, etc. Enclosed find check covering your invoice. Very truly yours,

REMINGTON STANDARD TYPEWRITER MFG. CO.

W. K. Jenne, Supt.

The Magnolia Anti-Friction Metal Co. of New York, having offices at Chicago, London, Berlin, Marseilles, St. Petersburg and Vienna, made greater sales and did more business in the month of September, this year, than they did the first 18 months of the company's existence, commencing several years ago.

The engine department of the Racine Hardware Mfg Co., Racine, Wis., is being kept very busy on both steam and gas engines. Recent shipments of their high speed automatic engine include orders from Butte City, Mont.; Bonham, Tex.; Stearns, Mich.; Peoria, Ill.; Detroit; Chicago; Houston, Tex.; Springfield, Mo.; Milwaukee, etc. They have closed a contract with the Edison General Electric Co. for one of their 10x10 engines, together with a 54x12 flange steel boiler, pump and heater, all to be set up and connected at the Veteran Soldiers' Home, Waupaca, Wis. This makes the second order placed with the Racine Hardware Mfg. Co. for one of their engines this fall.

The Herendeen Manufacturing Co., of Geneva, N. Y., have sent us the following extract from weekly report compiled by their head bookkeeper:—

"Monday morning, Oct. 19, 1891.

"Total number of boilers, both water and steam, built and shipped during past week, Oct. 12 to Oct. 17 inclusive, all sizes 54

"Total shipping weight in tons . . . 72

"Amount of boiler invoices for week . $11,609.25"

They state that their facilities are now so complete for manufacturing, that they are able to fill orders after this date within 36 hours from the time of their receipt.

Their sales up to date show a net increase of more than 50 per cent. over the same period in 1890. And for rapid and solid growth, for enthusiastic friends and agents of the "Faultless Furman" all over the country, for volume of business in 1891, they challenge comparison with any other manufacturer of improved heating boilers in America,

THE WESTON ENGINE.

Correspondence in reference to the Weston engine, a full illustrated description of which appeared in our last issue, should be addressed to Messrs. Julian Scholl & Co., 40 Cortlandt street, New York.

SITUATION WANTED

As engineer, by a thoroughly experienced and reliable man, highly recommended. Address "Steam," care of THE AMERICAN ENGINEER, 1302 Pontiac Building, 358 Dearborn street, Chicago.

CONTRACTS OPEN.

Proposals.—Sealed proposals will be received at the office of the Illinois Board of World's Fair Commissioners, Room 18 Montauk Building, in Chicago, until 12 o'clock m. on the 18th day of November, 1891, for all the labor and material required for the erection and completion of the Illinois Building for the World's Columbian Exposition at Chicago in accordance with the drawings, general instructions, conditions, and specifications (copies of which may be seen at the office of the Commissioners in Chicago and on application to the architects, W. W. Boyington & Co., 157 La Salle street, Room 107, on and after Oct. 26, 1891.)

Each proposal, whether for a part or the whole of the work, must be accompanied by a certified check for a sum not less than 3 per cent of the amount of the proposal, drawn in favor of the Director-in-Chief of the Illinois Board of World's Fair Commissioners.

The Commissioners will reject all bids received after the time herein stated for opening the same, also bids which do not strictly comply with all the requirements of this invitation. The Commissioners also reserve the right to reject any or all bids. Proposals must be inclosed in sealed envelopes, including schedule of work and material and check, and marked "Proposal for the Illinois State Building for the World's Columbian Exposition," addressed to John P. Reynolds, Director-in-Chief of the Illinois Board of World's Fair Commissioners. This 15th day of October, 1891. W. C. GARRARD, Secretary Illinois Board of World's Fair Commissioners.

Pumping Machinery.—Sealed proposals will be received by the Board of Water and Lighting Commissioners of the city of McKeesport, Pa., until noon on the 5th day of November, 1891, for the furnishing and erection of two (2) three million gallon horizontal duplex direct acting, compound condensing, or non-compound condensing, rotative pumping engines, of the outside center packed water plunger pattern, for the McKeesport Water Works; together with all appurtenances and connections thereto, as set forth in the specifications for said engines, now in the office of the Superintendent of Water Works.

Said Board of Commissioners reserve the right to reject any or all proposals.

Copies of specifications will be mailed upon application. All proposals shall be endorsed "Proposals for Pumping Machinery" and directed to the undersigned. By order of the Board. JOS. ECOFF, Superintendent.

Approaches to U. S. Court House, Etc.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock p. m. on the 5th day of November, 1891, for all the labor and materials required for the approaches to the U. S. Court House and Post Office, at Texarkana, Ark. Texas, in accordance with the drawing and specification, copies of which may be had at this office, or the office of the Superintendent at Texarkana, Ark., Texas. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in envelopes, sealed and marked, "Proposals for the Approaches to the U. S. Court House and Post Office building at Texarkana, Ark., Texas," and addressed to W. J. EDBROOKE, Supervising Architect.

NOVEMBER 7, 1891. **The American Engineer.** VOL. 22, NO. 19.

"HANDY" RATCHET SCREW DRIVER.

The accompanying screw driver cuts represent a new style of screw drivers, working on a new principle patented last year, which are manufactured and placed on the market by the Augusta Machine Works, Augusta, Maine.

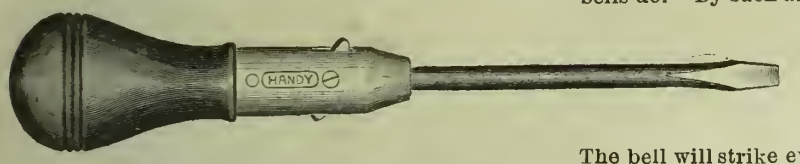
The ratchet appliance is very "cnte," and has made this tool a great favorite with all classes of mechanics, electricians, amateurs, and all who have occasion to use such tools.

For rapidity and ease, or convenience of operation it has no equal, as it will operate to turn a screw in or ont, or from right to left, by simply touching the pawl lightly with the finger, without changing the position of the tool in the hand, or removing the blade from the screw.

The ratchet, pawl, and all of the working parts are manufactured from steel.

The blades are hand forged from special steel made expressly for these tools, and they are all carefully tempered and thoroughly inspected.

All of the parts are finely proportioned, nicely finished, and combine the greatest possible strength



and durability, with elegance of style, making it the most desirable tool of its class yet placed on the market. Such is the claim of the Angusta (Me.) Machine Works. And the claim is made good by specimens of these elegant screw drivers which we have received.

The lower cnt shows their No. 1, or pocket size, the whole length of which is 5¼ inches. The illustration is exactly three-fourths of the size of the tool. This No. 1 is extremely handy, and is specially adapted for electrical, telephone or store services, and all work where a convenient screw driver is needed. It is strong, light, and neat. The price of these is only $6 per dozen, subject to disconnt.

The other illustration (the upper cut) gives a good idea of the handy ratchet screw drivers with longer blades, viz. 4, 5, 6, 7, and 8 inches, the whole length thereof (that is including the handles) varying from 9 to 14 inches.

The pawl is easily discerned in the "picture." When one knob is down the blade is fixed so that it will drive in the screw, in the regular way; but if the screw is to be withdrawn, entirely, or in part,

that knob is to be lifted up, so that the other one is turned down, in order to turn the screw leftwards.

These new screw drivers have a tendency to "command respect," inasmuch as it is evident they should not be thrown down recklessly, as is the fate of many screw drivers. The "Handy" must be handled properly in order to make it last handy for a generation or two.

There will not be less than 25 restaurants, as well as numerous cafes, in the Exposition buildings. It is the intention of the Exposition authorities to protect visitors from exhorbitant charges.

The Minnesota World's Fair Commission is determined to increase in some way the $50,000 which the legislature appropriated for Exposition purposes, as it believes a much larger sum is necessary if the state is to be creditably represented. It has issued an address to the counties urging each to raise its portion of $100,000, and has pledged its members to go before the next legislature and endeavor to secure the passage of a bill refunding the amounts thus raised.

CINCINNATI'S BIG BELL.

Mr. Frank S. Neal, grand chief engineer, A. O. S. E., of Ohio, has sent us the following description of a new bell, which was cast October 24, for the City Hall, Cincinnati. It was cast at the Buckeye Bell and Brass Foundry, on East Second street. It will be a monster. With the fixtures complete it will weigh about 6,000 pounds. The bell alone weighs about 4,500 pounds. It will be five feet in diameter across the mouth and four and a half feet high.

It will be the second largest in the city, the largest being that of St. John's Church, at Twelfth and Elm, which weighs 7,000 pounds. The key of the bell will be C and the tone will be very full in volume and of a powerful ringing sound, which on a clear day can be heard at a distance of four miles. It will be hung stationary, and will not be rung as church bells usually are. The bell will be used in connection with an E. Howard clock, which is now being manufactured at Boston. The bell will be sounded by being struck with the clock-hammer.

It was the intention of the City Hall Trustees to have the bell swung by a large wheel, as most large bells do. By such an arrangement the sound could have been heard a distance of ten miles. It was found that this could not be done in connection with a clock, so the idea had to be given up. The bell will strike every hour, and, together with the clock, is to be the official time-piece of the city, always giving the correct standard time which is warranted not to vary over two seconds in a month. There will be four dials to the clock, each ten and a half feet in diameter, and each illuminated by twelve electric lights, which will be lighted automatically by the clock at a previously determined time every day.

The wooden frame outside of the bell will be ten feet long. The composition of the bell is seventy-eight parts copper and twenty-two parts tin. This combination of metals is pronounced the best in the world by bell-makers to produce a strong bell with clear, ringing, loud sound and full volume.

At 11 o'clock in the morning the fire was started in the immense furnace and the workmen began throwing in the copper. This copper was in the form of ingots weighing thirteen and a half pounds each. About 2,500 of these were thrown into the furnace kettle at a time. At 5:35 o'clock in the evening the tin was thrown in on top of the now liqnid copper. The tin was in the form of long rectangular blocks, called "pigs." Nine of these were placed at the mouth of the furnace, one at a time, and shoved back to the kettle, into which they fell with a splash. At 5:43 the casting began. The stopper was knocked out of the gate and the fiery liquid shot out with a spurt into a narrow gutter about ten feet long, leading to the bell-mold.

It was a novel sight to see this stream of white liquid fire, running along with a sizzling, hissing sound and falling with a splash into the gigantic mold. It took exactly two minutes for the mold to fill up, whereupon the workmen again checked the fiery stream by plugging up the furnace opening with a stopper. The opening in the mold was very small, At the conclusion of the casting the dross floated at the top of the white liquid. All around the outside of the mold were numerous blue flames, caused by gas escaping from the vent holes.

The mold was made five days previously and consisted of two flasks, each coated with loam, baked dry as possible. Between these flasks the molten metals were poured. The proprietors of the foundry, Vanduzen & Tift. The tin used is block tin, imported direct from India, and the copper is from the Calumet and Hecla Mines, on the Michigan Peninsula, near Lake Superior.

The President of Uruguay has designated the Association Rural of that country as the National Commission to have charge of Uruguay's exhibit at Chicago in 1893.

MAKING TINPLATE IN AMERICA.

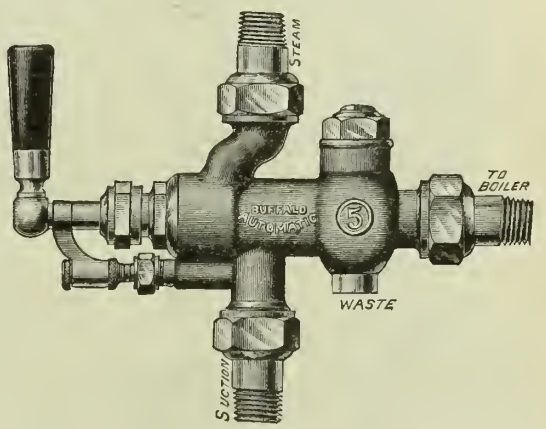
It has yet to be demonstrated whether the Americans can make and sell tinplates in successful competition with Welsh tin, says *The Ironmonger*. Bnt our London contemporary admits that it is evident the Americans devote considerable attention to improved machinery and appliances. "Among the new American appliances we notice a pickling-machine, invented and patented by Mr. D. T. Lewis, of Pittsburgh, which is claimed to be equal to pickling from 150 to 200 tons of 26-gauge black plates per day. In it only muriatic acid is used, instead of the muriatic and sulphuric acids now commonly employed.

"Another new appliance is a doubling-shear, which has been constructed by the Leechburg Foundry and Machine Company of Pittsburg. This appliance, including a vertical engine and connections, stands on a floor-space of only 4½ by 8½ feet and the principal advantage claimed for it is that the power and connections are all above the foundation, and that there is a fixed table. The sheet can be doubled at one stroke, owing to the fixed table and rigid arm. Welsh tinplate makers might also make inquiries respecting this machine, and their resolve generally should be to keep well abreast of all that their American competitors are doing."

Jonathan Columbus may get ahead of John Jones in spite of it all.

THE BUFFALO AUTOMATIC INJECTOR.

The accompanying injector illustration is that of the Buffalo automatic, manufactured and sold by



the Sherwood Manufacturing Co., 34 Washington street, Buffalo, N. Y. This is a new injector, which they have just patented. It is operated entirely by one handle. It is particularly adapted for use on traction, portable and marine boilers.

As they state in their prospectus, the capacity of this machine can be graded over fifty per cent., thus supplying the boiler with the exact quantity of water required to run the injector continuously. It works equally well whether lifting water or taking supply from overhead tanks, or city pressure, and does not require valves to regulate the machine, in either the steam or supply pipe, when in use under either condition—points that are not attained in any other machine made.

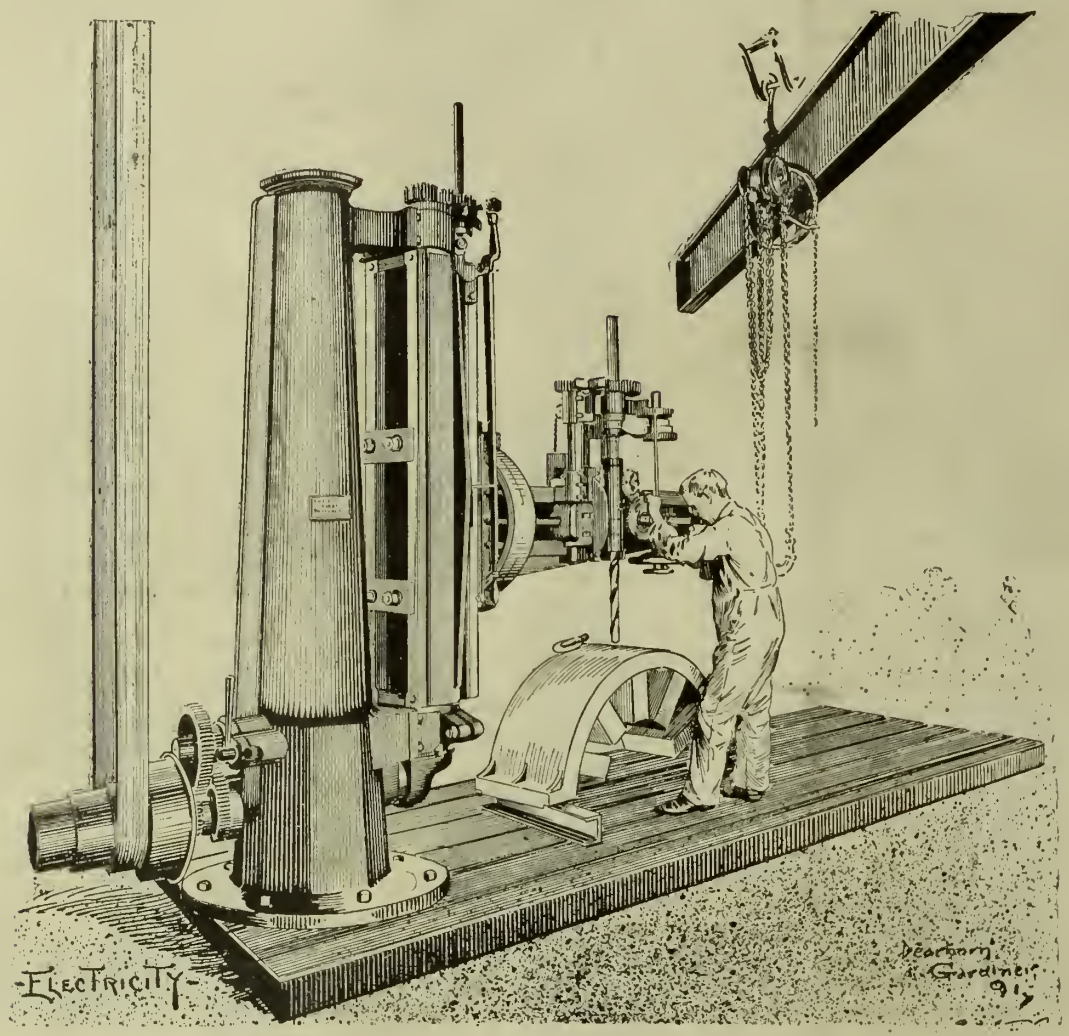
The Atlantic Transportation Company, operating a line of steamers between London and New York, has agreed to carry exhibits from London to either New York, Philadelphia or Baltimore free of charge except the actual expenses of loading and unloading. This generous proposition makes it possible for European exhibitors to have their displays brought to the American seaboard practically free of charge.

J. Allen Hornsby, Secretary of the Department of Electricity, who was sent to Frankfort-on-the-Main to study the Electrical Exposition there, has made a report, which shows that out of compliment to the Columbian Exposition the Frankfort Exposition was kept open a fortnight longer than was originally intended, in order to give Mr. Hornsby a chance for thorough investigation. Secretary Hornsby writes that there is electrical apparatus on exhibition at Frankfort which, when put in operation, will cause the eyes of American electricians to open in wonderment.

THE BIRTH OF A DYNAMO.

By Charles C. Randolph. *

Everybody who reads knows that wonderful strides have been make in recent years in the application of electricity. The evidences of this are to be found on every hand. We see cities and villages lighted by electricity, we see street cars propelled by it, we see printing presses and other machinery driven by it. That is as far as the knowledge of the masses goes with respect to this comparatively new industrial factor. Now let us see how the machine is built which furnishes the electrical energy to do all this useful work.



Drilling the Frames of Field Magnets.

Ask the average man what a dynamo is and you begin to uncover his weakness. Ask him if he knows how the dymano is made, or how many parts it has and what they are, and it is safe to wager that he will be unable to tell. It is the average man then that this sketch is designed to benefit. I shall try to treat the subject from a strictly non-professional standpoint. Doubtless the electrician who reads to the end will not question this intention.

The factory I selected in which to learn the why and wherefore of the dynamo was that of the Eddy Electric Manufacturing Company, of Windsor, Conn. This Company makes a specialty of the equipment of manufacturing establishments with electric power. Its factory is thoroughly well equipped with the best machinery and labor-saving devices, and its superintendent, Mr. George T. Briggs, is agreeable and willing to explain to the uninitiated the process of dynamo manufacture. He devoted two hours to me the other day and when I left him it seemed to me that a load of dense ignorance had been lifted from my shoulders.

Ninety men are employed by the Eddy Company, in a large three story brick building standing near the railroad depot in Windsor. Most of these are skilled mechanics and their work is divided into a number of departments. I began my tour of observation in the room devoted to the castings, where the iron frames of the field magnets—the foundation of the dynamo—are made. These castings are made of a special grade of soft iron. "They are of the ordinary horse shoe type," said Mr. Briggs. He referred to the casting in the condition in which it leaves this department of the factory. It takes three massive pieces of the metal to produce the likeness to the horse shoe. The two which form the sides are called by the electricians, limbs. The curved piece which joins them is termed the yoke. It will be well to keep these terms in mind.

While I stood looking at the heavy pieces of iron, a workman picked up one by means of a traveling electric crane, which enables one man to raise six tons, and lower it gently on a big planer capable of planing a piece of iron five feet square and fourteen feet long. He started the machine and the rough surface of the iron exposed to the knife gradually disappeared. Another limb was lifted and subjected to the same treatment. Then the yoke piece was planed so that it would accurately fit the limbs. The process did not take long, although the three pieces together weighed several tons.

A boring machine, a monster built to hold a piece of metal five feet in diameter, next received them. Four holes were bored through the yoke piece and in the limbs. Then four stout iron bolts made yoke and limbs one. Before they were bolted together, however, another feature of dynamo manufacture had to be attended to.

Not far from the castings a peculiar machine was at work. It was making the "field coils," without which a dynamo would be about as valuable as a horse with three legs. A glance at the picture of the completed dynamo will show the closely woven wire around the limbs of the machine. This is the field coil. When no current is passed through it the huge iron magnet, formidable as it looks, has no magnetic power, no attractive force. The moment a current circulates through the coil the field magnet becomes charged with magnetism, and there then exists in the neighborhood of the poles, that is, the free end of the limbs, what is known as a "magnetic field." If a wire be brought within the influence of this magnetic field, an electric current will be developed in the wire. High efficiency in the dynamo requires a strong magnetic field. It follows that the field coil is an object of much solicitude to the manufacturers.

The basis of the coil is a vulcanized fibre spool which is designed to fit the limbs of the casting. This spool is first placed in the peculiar winding machine I have mentioned, which is provided with a screw feed. Copper wire of the required size is wound by this machine round the spool, the screw feed operating to produce uniform layers, no two turns of the wire crossing each other. Each layer is insulated from the next by heavy insulating paper. Great care is taken to make the insulation perfect. A single defect, resulting in a contact between two wires of different layers, would ruin the dynamo.

In order to follow the process without delay from this point, let us suppose that the field magnet castings have been painted and polished and set down in the "assembling room" of the establishment. Lest this term may be too technical, I will say that in this room all the component parts of the dynamo are put together. The traveling crane transports the different pieces from point to point as they are needed. Quick workmen bolt the limbs I have described to a base of wood, which is accurately shown in the illustration. This wood is kiln-dried birch and is very strong. Some of these bases weigh 400 or 500 pounds. The field coils are now slipped over the limbs and the yoke piece is bolted tightly into place. Now we see the resemblance to the horse shoe magnet with which every schoolboy is familiar. In its present form this part of the machine is a magnet; but, in spite of its size, a very weak one.

If you consult your dictionary you will find that the word "magnet" means a lodestone—a species of iron ore which has the property of attracting iron and some of its ores. As a matter of fact, and this may be new to many, all cast iron has this property

* In *Electricity*.

to a greater or less degree. "All the castings that come to us have more or less magnetism," Mr. Briggs said to me. "Nature provides the initial power, limited though it may be, which makes the construction of the dynamo possible. With this power at his disposal man has found out how to develop and intensify it."

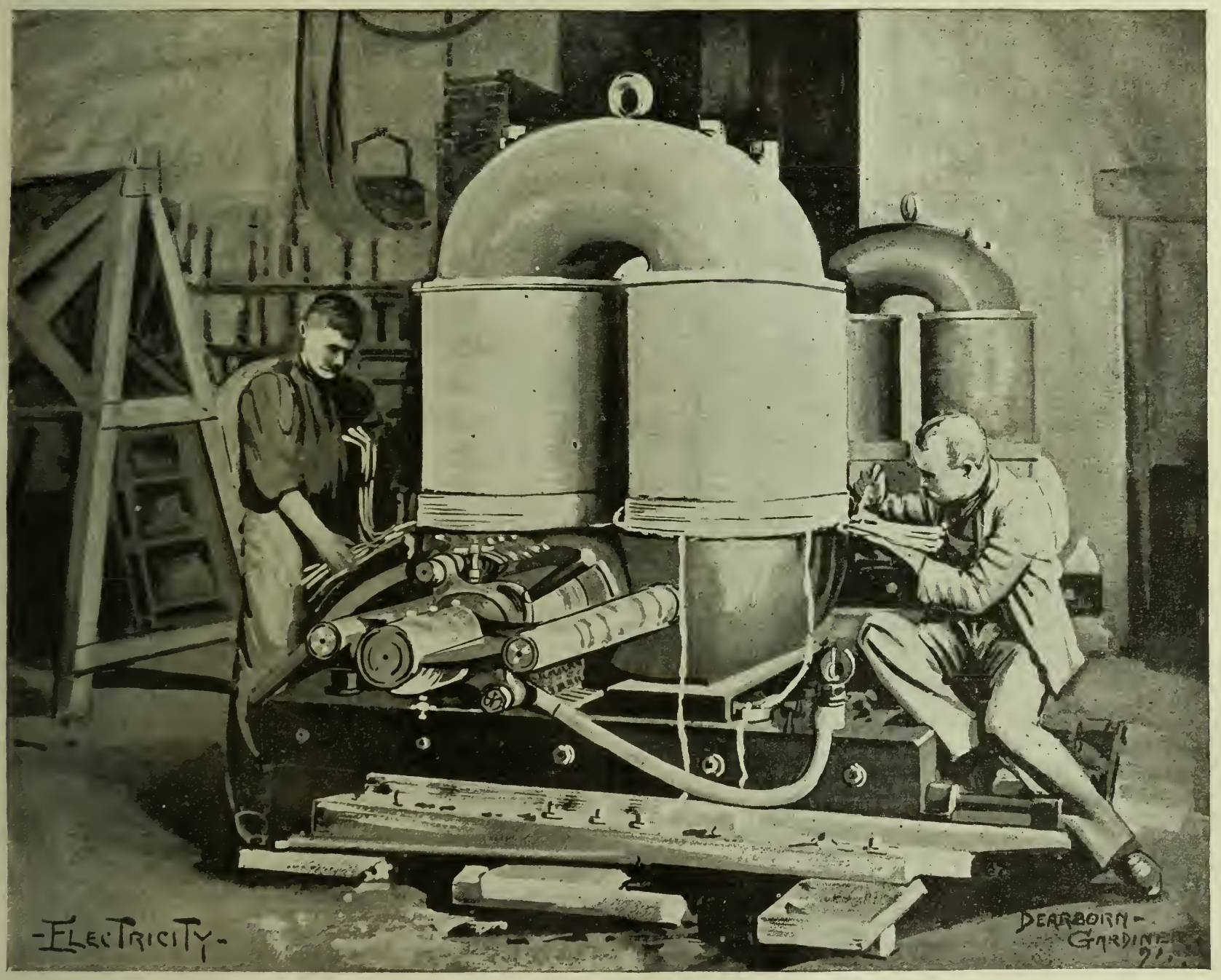
Before the iron limbs left the casting room their jaws or ends had been drilled to receive what are denominated studs—pieces of gun metal designed to support yokes of the same metal, which in turn holds the "armature." A study of the picture of the dynamo will aid largely in getting my meaning. Between the limbs of the wire-wound magnet you will see a cylinder extending several inches beyond them. The end piece holding this shaft is the yoke I have spoken of. You will observe that it is secured to the limbs of the magnet by round pieces of metal. These are the "studs." The cylinder is the armature.

tically a solid cylinder several inches or more in diameter according to the power which the dynamo is calculated to develop. String a lot of pennies tightly together and you have the exact appearance of this part of the armature.

The armature is not yet ready to go into the dynamo. A good deal of careful work has yet to be done on it. After the washers are tightly compressed the cylinder is taken to what is called the armature winding room. Here a dozen men and women are at work. In a very short time the core is thoroughly insulated. The skillful fingers of the operatives make speedy work of what, to the novice, seems like an interminable job. The insulation consists of cotton cloth and insulating paper, which is impregnated with shellac and carefully fastened to the core by means of a solution of the same substance, forming a complete insulating covering to the armature core. After being thoroughly dried, the core is ready for another process, that of winding.

is simple enough when analyzed. Completed it is a wonderfully complicated looking affair. Now comes the "commutator," which has an ugly look to the inexperienced eye.

Webster thus defines the word "commutator:" "A piece of apparatus used for reversing the direction of an electrical current; an attachment to certain electrical machines by means of which alternating currents are made to be continuous or to have the same direction." In the dynamo the commutator gives a uniform direction to the currents generated in the different coils. The armature of course, is wound with a large number of separate coils. As each coil moves past one pole of the field magnet a current is generated in it in one direction, as it moves past the other pole the direction of this current is reversed, so that without the commutator the currents from the armature would be rapidly alternating in direction. As it is necessary for most purposes to have a continuous current in one



Assembling a 100 Horse-Power Dynamo.

Webster defines the word "armature" as follows: "A piece of soft iron used to connect the two poles of a magnet or electro-magnet, in order to complete the circuit or to receive and supply the magnetic force. In the ordinary horse shoe magnet it serves to prevent the dissipation of the magnetic force."

In the Eddy dynamo a hard steel shaft of small diameter rests in the yokes already described. On this are secured hundreds of thin plates of soft sheet iron, separated from each other by paper washers. These form the core of the armatue. The sheet iron washers are each only thirty one-thousandths of an inch thick. The paper is tissue specially prepared for this purpose. At each end of the core a cast iron head, having a diameter equal to the external diameter of the washers, is threaded on the shaft. The washers are tightly compressed between the heads, thus making prac-

Each core, when it reaches this stage, is divided into a number of sections, from 36 to 100, according to the proposed power of the dynamo. Each section is wound with a certain number of coils of insulated copper wire. The winding is lengthwise, and is almost too intricate to be accurately described. This part of the work is about the most important detail of dynamo building, and is done with the most scrupulous care and nicety by highly trained operatives. It is all hand work, as no machine has yet been designed to supersede human skill in this delicate operation. After the winding of the armature is completed the wires are bound in a place by a number of bands of phosphor-bronze wire. These are insulated from the windings of the core by strips of mica.

You now know that the armature is a solid steel shaft strung with alternate washers of soft iron and paper, and wound with insulated copper wire. It

direction, the commutator corrects this state of affairs and reverses one set of currents at each revolution of the armature so as to produce general harmony.

The commutator is a cylinder made up of a number of segments of hard copper, insulated from each other by mica sheets, the whole being held together by a gun-metal sleeve with a flange at one end. This sleeve passes through the commutator, the copper and mica segments being built up around it, bringing the flange tightly against one end of the segments. A nut and washer on the other end serve to hold the segments together. Both the flange and the nut are "recessed" at a sufficient angle, and the ends of the copper segments turned to the same angle, so that they are held firmly in place. Every segment is insulated from the next and from the gun-metal cylinder by mica,

Continued on Page 190.

The American Engineer.

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CONTENTS OF THIS NUMBER.

FLY-WHEELS, when they burst, are as destructive and deadly as steam boilers when they explode. On page 190 we reproduce a letter from an English contemporary on the subject of fly-wheels. There should be some rule applicable to them to ensure safety in their operation.

EDUCATION should be the order of the day, or more especially of the night, now that the winter season is close at hand. The *American Machinist* has a timely article on this subject, headed "Stationary Engineers," which we print in another part of this number. Steam engineers and their employers would do well to "read, mark, learn and inwardly digest" the lessons contained therein. And the American Order of Steam Engineers, in particular, should set their conncils in educational order. Manufacturers of engines and steam devices, as well as those who employ steam engineers, can render valuable help, or give much encouragement, in various ways, especially in helping the councils of the Order to build up their libraries. In this issue, under Correspondence, Corresponding Engineer Frank Blum, returns thanks on behalf of St. Joseph Council, No. 2, of Mo., A. O. of S. E., for a beautiful book case presented to them by the Consolidated Tank Line Oil Co. Others may help by presenting books, or donate little sums of money to enable this council, and others, to purchase whatever ooks they stand most in need of.

DYNAMO building is now a craft in which many thousands are employed. In this issue we publish an illustrated article (by courtesy of the "Electricity" Newspaper Co., who have secured copyright thereon) entitled "The Birth of a Dynamo," by Mr. C. C. Randolph. Who Mr. Randolph is, we know not; he does not seem to be much of an electrician anyway, or, if he is, he is at a great loss of language to express his own thoughts, for he turns to Webster pretty often. This affords a good hint to our readers, namely that the latest edition of Webster (the International) contains useful descriptions of electric apparatus and definitions of electrical terms not to be found elsewhere. And as thousands of our readers are anxious to have their intellectual appetites whetted for electrical knowledge, we present this amateur article by Mr. Randolph thinking it may prove more beneficial than a treatise by an expert electrician. If Mr. Randolph is himself an expert, he has disguised his abilities pretty well, and writes in a style as if he knows no more than a tyro among dynamo tenders. If he has done this, it is to entice those who know but little concerning the construction of electric machines, and his article may afford courage to those who have everything to learn, concerning electrical science. *Electricity*, from which the article is taken, is one of the youngest journals in the electrical field, and it aims to be popular as well as scientific.

BEST FOR ALL.

As announced in our last issue, S. C. E. Jefferson Young, Jr., has returned to Syracuse, N. Y., and has again made that city his residence and headquarters. And there he will feel more at home, probably, as long as he continues to be Supreme Chief of the A. O. of S. E.

Mr. Young moved to Chicago in September and assumed the position of manager of the AMERICAN ENGINEER. He soon found out that to be tied down to an office chair was most uncongenial for him: a place very different to life on board ship or "on the road."

In short Mr. Young was entirely out of his element in a newspaper office, and he very wisely resigned his new and incongruous position. Mr. Robert Forsyth, president of the American Engineer Publishing Co., unhesitatingly accepted his resignation at once, and released him from all connection whatever with the offices of the paper, thus placing the Supreme Chief Engineer at full liberty to devote his time and energies entirely for the good of the American Order of Steam Engineers.

The Order needed him more than the paper. And the officers and members of the A. O. S. E. will probably agree that Mr. Young did a very wise thing in getting out of the newspaper office, and that President Forsyth's readiness to release him was most commendable and very much for the good of the Order, as well as the good of the AMERICAN ENGINEER.

Mr. Young's failing has been an insane desire to run a paper, without relinquishing his position as Supreme Chief. There are many men in the Order who are greatly superior to Mr. Young in education and the finer qualities of mind and heart. Several of these have complained repeatedly of the "Jeffy mud-pies," as they called them, which crept into the columns of the Order's official organ, almost unavoidably, so long as he was associated with our editorial department. It was useless to point out the gross impropriety thereof, and his own relatives and best friends remonstrated with him in vain. All that is now gone by.

Mr. Jefferson Young, Jr., although "he does some queer things sometimes" (as one of his best friends writes), yet he has many good points, and he has done so much towards the building up of the American Order of S. E., as to atone in some measure for his shortcomings.

The Order has now grown to such proportions, however, and the majority of its members are so anxious to make as much progress as possible in steam engineering science, that they wish their chief would be more in earnest, and render them proper help in collecting valuable libraries and in reaching after the higher education which will enable them to stand on top in their chosen profession.

Of late, there has been much complaining, and justly so, that the best interests of the Order are not being properly looked after. The severance of Mr. Young's connection with this paper will give him a chance to perform his duties as Supreme Chief Engineer of the Order more thoroughly than in the past.

HARRY E. HOHN ON HIS NEW LEGS.

The readers of the AMERICAN ENGINEER are generally familiar with Bro. Harry E. Hohn, of Philadelphia, who met with the great misfortune of losing both legs while discharging his duties as an engineer. Several councils of the A. O. S. E. as well as individual members, and a few well-known manufacturers of steam appliances and dealers therein, have contributed various sums towards getting him a good pair of artificial legs, and to start him in business.

It is not difficult to imagine how a man with one artificial leg can use it if he has one genuine or natural leg to depend on. But those who have always enjoyed the use of a good pair of legs can hardly form any idea of what a man feels when he learns to walk with two "false" legs. Bro. Harry E. Hohn has been through this strange experience, and he describes his feeling in the following letter, which he seems to have written somewhat under the shadow of "the richest man in Rotterdam." His letter will make many who heartily sympathize with him in his sad misfortune feel very glad.

PORT DEPOSIT, MD., Oct. 20, 1891.

Editor, American Engineer:

Please inform the brothers of our noble Order (the A. O. of S. E.) that I have received my artificial limbs from New York. And I am getting about on them much better than I thought I would.

It was a strange experience that I passed through with them at first, and it was several days before I felt natural with them.

I received a letter from the firm in New York the day before the legs came, saying that I would receive my limbs the next day by the ten o'clock express. Of course there was not much sleep for me that night, for the legs were so much on my mind that I could see legs hanging around the room everywhere. But before the morning dawn I fell asleep, and did not awake until it was almost time for the express to come. I had hardly got through my breakfast when the door-bell rang.

(Well, boys, you may talk about your fast walking; but you should have seen my fast sliding to open that door.) It did not take me long to reach the front door, and I knew what there was, for as soon as I got in the hall my eyes caught a glimpse of a box about three feet long.

I had no patience to take off the screws, but used a hatchet to make the splinters fly, and the lid was soon off. The fleshy looking objects which lay in the box somewhat staggered me. I proceeded to take one out, but stopped: I almost felt afraid of them. A friend of mine, who was present at the time, said, "they won't kick you, man," and lifted them out. Then I picked up enough courage to handle one of them myself.

After we got acquainted (my legs and I,) I felt anxious to try them on. My friend and I went into the front room, to put on my new legs. Everything was correct, for the legs fitted quite right. It was a difficult task to learn to walk, but before night I was able to do it.

After we screwed the legs on tight, the fine shape gave me great delight. But when I started to walk I was in too much of a hurry, or something, and I could not balance myself. And I fell down so many times that I almost got tired of the good things with which I had been so highly blessed. But every time I fell it was only to get up again, and "try, try, try again" was my motto. The trouble was I went too rapidly; the speed they seemed to have frightened me.

At last I learned to walk! I was delightfully amazed. I walked along the streets and across the squares in a manner that made folks stare. Every store I passed had its business interrupted, for the people looked out to see me walk. And the speed got so great that I really looked like a man running a race. I took a bound and a hop alternately. And at last I went so fast that I could not stop when I wanted to. Horror and fright were in my face, my friends said.

Failing to stop, I made for a lamp post. One leg seemed to have more spring than the other, at first, and they switched me from the lamp post just as I

was going to take hold of it. Then I was afraid to stop, or couldn't, and called for help. "O, stop me, or my legs will murder me," I shouted.

"But though they heard me aid invite, in less than a minute I was out of sight." Poetically speaking, I went over hills, public roads and lanes, and to ease my weary bones I famed to throw myself down, but all in vain, for my legs got up, and I was off again.

It was now getting dark, night was coming on fast. And I thought, for sure, that I would be overtaken by the darkness, and heartily wished I had one of the Engineers' torches to light my way.

Anyway, I reached home all right, enjoyed the heartiest supper I had for many a day, and had a good nights' rest. But next morning I felt so tired and sore, as if all my bones had been pulverized, that I had to rest for a whole week. Afterwards I used my legs a little at a time, and did not let them race away with me any more. Now I am all right, and able to walk sensibly.

The boys must not be surprised if they see me walking into their engine rooms on my rubber feet, and with an elastic step, just like a dude.

There is one thing which I can't be troubled with any more—corns and bunions. And I will have the advantage of my brother engineers in 1893, for I shall be able to waltz with a Chicago girl, and my rubber feet will be insensible to any danger.

(You fellows call yourselves engineers, but I am an engineer and an engine too, for I have got cylinders in my legs. Can any of you beat that?)

Yours truly,

Harry E. Hohn.

Copyright.)

LOCALIZATION AND REMEDY OF TROUBLES IN DYNAMOS AND MOTORS.—VI.

By Prof. Francis B. Crocker and Dr. S. S. Wheeler.

Continued from Page 168.

VI.—SPEED TOO HIGH OR LOW.

This kind of trouble in either dynamo or motor is a serious matter, and it is always desirable, and generally imperative, to shut off the current immediately and make a careful investigation of the trouble.

1st Cause.—*Overload.* (See Sparking, No. 1.)

Symptom.—Armature runs slower than usual. Bad sparking at commutator. Ammeter indicates excessive current. Armature or bearings heat. Belt very tight on tension side.

REMEDY. — Reduce the load on machine by taking off lamps in the case of a dynamo, or mechanical work in the case of a motor; decrease the diameter of driving pulley or increase the diameter of driven pulley.

2nd Cause.—*Short Circuit in Armature.*

Symptom and remedy same as Heating of Armature, No. 2.

3rd Cause. — *Armature runs slowly because it strikes pole-pieces.* Symptom and remedy the same as Noise, No. 2.

4th Cause. — *Armature runs slowly because its shaft does not revolve freely in the bearings.*

Symptom.—Armature turns hard by hand; bearings and shaft heat when running.

REMEDY.—Oil the bearings; clean and smooth, if necessary, the shaft and bearings; line up the bearings. See Heating of Bearings, all cases.

5th Cause.—*Field magnetism weak.*

This has the effect of making a motor run too fast or too slow, or in some cases even run backwards, but makes a dynamo fail to "build up" or excite its field and give the proper voltage.

Symptom and remedy the same as Sparking, No. 7.

There have been distributed 10,000 of the lithographs of Machinery Hall, of which New York City and State have received the largest number. Over 1,000 requests are now on file from leading manufacturers, merchants and importers of New York City and Eastern States.

OUR FRIENDS.

4—JEREMIAH LEAHEY JR.

The original of the accompanying photograph was born in the city of New York, December 19, 1857. The parents moved to Woodbridge, N. J., when "Jerry" was about two years old.

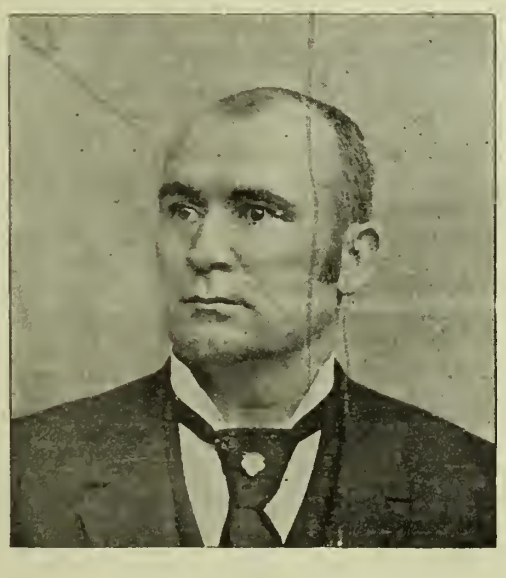
At the early age of seven years he was put to work on a farm. Here he remained about two years, after which he worked in the clay-banks in this vicinity for a year and a half. But being of a roving disposition he left his home when about twelve years of age, and going to Pennsylvania found work on a canal boat on the Schuylkill canal.

This position brought him to Philadelphia where he endeavored many times to obtain employment in the Baldwin Locomotive Works. After repeated failures he gave up the attempt, and turned his attention to steam-boating.

He was then offered the position of "firing" on a tug-boat which plied on the Delaware river; but finding this work too heavy for him, and hearing of an opening on the Raritan canal, he at once accepted it, and here he remained till about November 1877.

He was now offered the position of fireman by the N. Y. & So Amboy steamboat Co., which position gave him, for the first time, an opportunity to gratify his natural propensity for running a steam-engine.

Here, working himself up to the position of engineer, he remained until 1880, when he took charge



Jeremiah Leahey, Jr.

of the pumping engine in the Bloomfield Clay Mines and there he worked six months, after which time he resigned in order to take the position of assistant engineer with the N. Y. & South Amboy Steamboat Co., where he rapidly rose to be "first assistant engineer" of the line.

Mr. Leahey resigned this position in 1881, to become chief engineer of the Perth Amboy Water Works, which position he yet holds.

Mr. Leahey's earlier opportunities for study was very limited. While acting as fireman on the steamboat running between N. Y. and South Amboy, Douglass McFadden, of Philadelphia, was engineer, and through his kindly interest in young Leahey, the latter was able to master simple division in arithmetic, for which assistance he yet holds the most grateful remembrance.

But it was not until after he had found employment with the Perth Amboy Water Co. that he had the opportunity of attending a night school where he was under the tutelage of Prof. W. W. Warner. Through this gentleman's judicious instruction Mr. Leahey was enabled to master common and decimal fractions, and to acquire an adequate knowledge of square and cube roots, all in one winter's course of study, for which he feels indebted to Prof. Warner for the fatherly interest taken in the instruction that enabled him in his leisure moments, to take up the higher mathematics which he has pursued with great success, producing, as a result, many very valuable "tables" in practical engineering and other inventions applicable to Mr. Leahey's specialties, water and mechanical engineering.

Thus our friend and associate editor, Jeremiah Leahey, is to a great extent a self-made man. Our readers may look for contributions from his pen frequently. And he has another of his veluable tables in course of preparation for the American Engineer. Mr. Leahey, it may be remarked, is a quite young man, being under thirty-four years of age. He is one of the chief pillars of the A. O. of S. E. And his faithfulness, modesty, and natural good humor have won for him the admiration and good will of a host of friends.

STATIONARY ENGINEERS.

Just now is the time of year when associations of stationary engineers should begin their winter's work in earnest. These associations base their usefulness mainly upon being educational factors, and the long, cool evening now ensuing should, and undoubtedly will, prove an incentive to activity.

The art of stationary engine running is, it is true, one that cannot be learned otherwise than by actual practice, but such schools as the numerous socities of stationary engineers can organize may be a wonderful help in perfecting the members in the art. When, for example, fifty working engineers meet together at stated intervals, their collective information represents a vast amount of knowledge. Nearly every one of them has solved some problem in the line of his work that the others have not solved, and the point should be to bring this out for the benefit of all.

To much dependence is placed, in engineers' societies as in all other similar societies, on eminent lecturers. Lectures by such men should by no means be despised. On the contrary, the services of men competent to give information should always be obtained when at all practicable. But this should not be the entire or the principal aim of engineers' associations. Their meetings should be so conducted as to bring out, from time to time, the combined knowledge of the membership on the diverse points connected with the business of competently managing a steam plant.

The number of stationary engineers in this country is not known, but it is many thousand. Steam has grown so rapidly into use that those who manage its use have come to be a large army. And just as in every branch of business the supply meets the demand—meets it frequently in a way just about as a mechanic shop or a foundry could be filled with laborers—so the demand for engineers is met. But this is not the way the demand for engineers should be met. Not only for economical reasons, but for reasons of safetey, good men—men who have made a study of their business—are required.

A good deal of harm has been done the steam engineers by the builders of engines who have made a point of advertising that their engines did not require an engineer to operate them. No steam engine can be properly operated without the service of an engineer. The assumption that a steam engine doctor can come around once in a while and make everything right is fallacious. The engineer must be the doctor, with his figner always on the pulse of his patient.

There is no school, properly speaking, for stationary engineers. If there were such a school it could no more make a stationary engineer than a law college could make a competent lawyer, or a medical college a doctor. Either one of the illustrations named can grant a diploma, but so far as competency is concerned it amounts to very little. Men employ the lawyer who manages their cases well, or the doctor who prescribes the right medicine for the case in hand. Lawyers and doctors alike learn by experience—by their own experience, and by the experience of others. All learn largely by the experience of others. And this should be the case with stationary engineers. They should patronize the meetings of their associations, giving and receiving information.

It is astonishing how much may be accomplished in this way. As an example, the writer recently had the pleasure of attending a meeting of stationary engineers at which a member brought up a case of some trouble in steam heating in a large building. And he does not hesitate to say that the information volunteered by the members present was more comprehensive in its scope than that which

could be obtained through any book ever published on the subject of steam heating. It was the united efforts of all to help an individual out of his trouble.

There is one thing that comes in in this connection. That is the status of employers in relation to the purely educational societies of stationary engineers. Employers are by no means bound to assist in the education of their engineers. Men get pay for what they know and can do; but there is nothing that so helps a man along and nerves him for better effort, as the knowledge of the fact that the man who pays him his salary, or wages, appreciates his efforts to always do better. It may be a curious fact, but it is a fact, nevertheless, that a man who receives the pay of another likes to know that his services are appreciated. Now when employers of steam engineers—or any other class of men, for that matter—see their men trying all the while to do better, spending their leisure time—perhaps burning the midnight oil—in becoming more proficient in their business, or in correcting some evil, it is as certain as anything can be that these men will appreciate some encouragement in what they are doing.

When an employer forgets this he makes a mistake—not a small mistake, but a large one.

To apply this to the stationary engineer, when his employer fails to recognize the fact that his engineer is working with all his energy, and to the extent of his ability, to reduce the cost of running his plant, he misses an important point.

The moral we draw from this is that the employer should co-operate with his engineer, or engineers, in giving him or them such encouragement as he can in perfecting his own or their knowledge in the use of steam.

To put it more plainly, the employer of stationary engineers should encourage the societies of stationary engineers that have for their object the perfection of their membership in the production and ultization of steam. This granted, there is no better way to accomplish the end than for employers to be present at the opening meeting of such associations, and to freely express their views on the subjects under discussion.—*American Machinist.*

RELIABLE ADVERTISERS.

Engineers Have to Advise Employers.

My plant is that of the largest picture-moulding factory* west of the Mississippi river, selling all over the eastern states, as well as western, and exporting goods largely to other countries. When in need of anything new in my plant, I always consult the advertisements in the American Engineer before buying, and always find the best of what I want. Among recent purchases made by this company, all from American Engineer advertisers, are engines, pumps, heaters, elevator, valves, pressure regulators etc.

All the members of our council (Laclede No. 1) do likewise. And we congratulate the American Engineer on keeping before the public only good reliable firms, whom we can all safely rely on for quality and moderation in prices.

J. W. Wood.

*That of the J. R. Webber Moulding Co., St. Louis.

A $10,000 model of a stamp mill for reducing copper, now the property of the State Museum of Michigan, will be shown at the Fair. This model was made and presented by the Calumet and Hecla Copper Company.

At the Eisteddfod, which Welsh societies will hold at the Exposition, the finest choruses of Wales will be present and prizes amounting to $30,000 have been offered in connection with the contest. For the finest Welsh chorus a prize of $5,000 is to be given. Another of $4,000 is offered, and so on in smaller amounts until the limit of $30,000 shall have been reached. The famous Dowlais Harmonic Society, 250 voices strong, will be among the contestants. It has won many prizes in Europe. Its trip to the Exposition will cost about $25,000, which sum it hopes to regain by giving a series of concerts in the United States. The festival is to last five days and be held in the Music Hall of the Exposition. One concert is to be given free of charge to the general public.

THE BIRTH OF A DYNAMO.

Continued from Page 187.

as it is highly necessary that there be no electrical contact between them.

The commutator is slipped on the armature shaft and the ends of the different coils of wire which were wound on the armature are carefully soldered to the copper segments. These ends are then covered with parchment to protect them in place. If you look at the picture of the dynamo, or examine the dynamo in some electric light factory, you will easily distinguish the commutator. It is a handsome piece of work, made absolutely perfect by the methods employed in electrical machine factories.

After the commutator is attached to the armature, that important part of the dynamo is taken to a grinding machine near by, where the bearing surfaces of its shaft are given a true cylindrical surface. After the grinding is over and while the cylinder is still revolving it is carefully rubbed with an oil stone. Then the armature is sent to the drying-room. There it remains thirty-six hours, at the expiration of which time it is ready to take its place in the embrace of the field magnets. It is pushed in between the jaws or poles of the magnet, and the shaft slides into the bearings.

The work of completing the attachments is quite simple. A pulley, which takes the power from the driving belt of the engine when the dynamo is at work, is adjusted to the end of the shaft furthest from the commutator and fastened by a key and nut. The "brushes" are then adjusted.

What are the brushes? Webster says they are "thin plates of metal used to conduct an electrical current to or from the commutator of a dynamo, electric motor or similar apparatus." The brushes are made up of strips of sheet copper, each from one-eighth to one-half inch in thickness. Their ends bear on diametrical opposite points of the commutator. In a nutshell, the object of the brushes is to collect the current generated by the dynamo so that it can be fed into the conducting wires and distributed. The current passes from the armature coils to the segments, from which it is taken up by the brushes, and by them it is delivered to the main wires to be used for light or power. The buzzing sound inseparable from a dynamo in motion is due to the friction of the brushes upon the commutator.

We have traced the growth of the dynamo from the casting. It now stands before us a complete machine, its pully ready to receive power from the belt of the engine, and convert it into all adaptable electrical energy. We have discovered how the different parts are created and combined, and we know something of what they are expected to perform. And yet there is a good deal of wonder concerning the dynamo and how it does it. How can power come from a union of cast iron, copper wire, sheet iron and paper? I asked the question of Mr. Briggs, regardless of the shock I might inflict upon his scientific system. This is about what he said in reply: All the iron we use is, as I told you at the beginning of your inquiry, slightly magnetic. If it is not we magnetize it by means of a strong current. We are sure of a small quantity of residual magnetism in the iron frame of the magnet. This residual magnetism does the business. The engine is started, the rapid revolution of the armature which connects the two poles of the magnet, generates in it a current from the reserve fund, this current passes to the field coils, which are connected through a sort of by-path to the winding of the armature, and charges then to their full strength.

A powerful magnetic field is then created between the poles of the magnet, and as the armature is revolving in the very centre of this field, current is generated in the coils of the armature. Thus two principal parts of the machine help each other. There is sufficient magnetism about the machine to cause the generation of current to begin directly the armature is revolved. A portion of this current goes to the coils of the field magnets and at once strengthens their magnetism, which naturally causes a corresponding increase of strength in the currents generated in the armature. In a very short time the magnetic field attains its full strength and the dynamo is developing the full amount of energy for which it was designed. This, in a few words, is the beautiful principle of the self-exciting dynamo. Of the power supplied to the dynamo by the driving engine, it delivers about nine-tenths in the form of electrical energy, available for lighting, for driving motors, for electro-plating, for the reduction of ores, and for dozens of other useful purposes. A very small percentage of the power is used in the dynamo itself for energizing the field magnets.

The mechanical parts of the electric motor are the same as those of the dynamo. The winding is practically the same; with but few exceptions. The motor simply reconverts, to quote Mr. Briggs, "the electrical energy into mechanical energy and renders available for useful work the power which is driving the dynamo at the other end of the line." The electric motor is in no sense a prime mover, it is simply an element in a system for transmitting power.

FLYWHEELS.

In our last issue we published reports of the bursting of two flywheels. In this connection the following letter in *Engineerig*, (London), from Mr Neate of Rochester, Eng., is of special interest:—

I have lately been searching for reliable information as to weight of flywheels for engines for various duties.

If you think the subject of sufficient general interest to raise a discussion upon I shall be obliged if you will insert the following remarks written with the object of provoking criticism.

1. No rule that I have yet come across makes any distinction between single and double-acting cylinders, or single, double, and treble cranks, the Molesworth gives the exquisitely simple rule (among others) of "1001b rim per indicated horse power," irrespective of speed, diameter, or any other factor!

Now I have to suggest that a rule should be constructed having as a basis the number of single strokes per minute.

I would take the number of foot-pounds of energy in each single stroke (4 per revolution in a pair cylinder double-acting engine) and say that the foot-ponnds of energy stored up in the flywheel rim when rotating at its normal speed shall be a certain number of times this amount, from almost nothing in the case of a marine engine to, perhaps, 100 times in the case of a cotton mill engine.

If load fluctuated violently, or if governors were insensitive the factor would have to be increased, but for a steady load, good governor, and machinery not specially affected by slight changes of velocity, I see no reason why the store of energy in a flywheel should exceed 15 to 20 single strokes of the engine.

I am aware that the momentum of piston, etc., is a factor, but as the moving parts absorb power when the pressure in cylinder is highest and give it out again during expansion, this momentum acts as an equalizer rather than as a disturber, and may in most cases be neglected.

By the above rule if two single-cylinder double-acting engines had two flywheels each and were placed with their crankshafts in line, then by coupling the cranks so as to get four equidistant strokes per revolution, my rule would indicate that two of the flywheels might be dispensed with and the two remaining ones might very probably give greater steadiness than either of the single engines possessed, owing to the fact that there are not only no dead points, but that the rotative effect of each single stroke (including steam pressure and momentum) overlaps considerably that of the previous and subsequent strokes.

If the governor was sufficiently sensitive to respond sharply to variations in load, then one flywheel on the coupled engines should be as good as four on the single engines, but the proposed formula makes allowances for the sluggishness of governors which is usually advisable.

To show the diversity of practice in respect of flywheels, I may mention that there are two single-cylinder engines in this town (Rochester), both by makers of repute. In one the flywheel carries the energy of fifty strokes, and in the other (until recently altered) the energy amounted to but four strokes. I am, yours truly,

Percy J. Neate.

CORRESPONDENCE.

Donations Thankfully Received.

Editor, American Engineer:

St. Joseph Council No. 2, A. O. of S. E., of Mo., wishes to return thanks through the AMERICAN ENGINEER to the Consolidated Tank Line Oil Co. for the beautiful book case they presented us with.

The case is a dandy, and cost $18, and we justly feel very proud of it.

We very respectfully suggest to the balance of the oil dealers, throughout the country, that they place their advertisement in some good book on Engineering and send it to us, thereby helping us to complete our library, and at the same time advertising themselves.

Any donation of any kind that will be of use to us will be thankfully received.

Yours fraternally,

FRANK BLUM.

TRANSMISSION OF ELECTRIC POWER.

The successful transmission of power by electricity from the water power at Lauffen, on the Neckar, in Germany, to Frankfort-on-the-Main, a distance of over one hundred miles, has opened up great possibilities in that direction. The project to transfer power from Niagara Falls to Chicago was mentioned in one of our recent issues. Now comes the report of a scheme to transfer the water power at Folsom, on the American River, by electricity, to the City of Sacramento, Cal. The distance is only twenty miles. But they never thought of transmitting electric energy that distance permanently until the practicability of such a scheme was demonstrated in connection with the Electrical Exposition at Frankfort.

As remarked in the New York *Tribune* "never before was so striking an attempt made in this department of electric engineering. Not only all those directly concerned in it, but electricians and mechanical engineers all over the world have watched the progress of the work with intense solicitude. The result of the great experiment would, they believed, mark a new era in mechanical science.

"What was the problem? To convey the water-power of the Neckar River, at Lauffen, Wurtemburg, over a wire to Frankfort and utilize it there. It was therefore as if one had proposed to gather power from the Hudson River at Albany, transmit it by telegraph to New York, and there set it to running machinery, making a turbine wheel at Albany run an engine in New York with only a telegraph wire connecting them. One would say this is a hard thing to achieve. But these German engineers went at it in earnest. So did the statesmen, for the line of transmission passed through the territory of three states—Wurtemburg, Baden and Hesse. But the three Governments not only gladly gave permission, but did all in their power to facilitate the work.

"Lauffen is an interesting little town, on both sides of the Neckar. There is one picturesque but rather ruinous old bridge across the river there. The chief industry is the manufacture of cement, in which the place leads all other towns of Europe. A fine system of turbine wheels supplies the motive power for the works; or rather utilizes the power of the Neckar's current. They are placed in a race-way at the side of the river, a mile or so above the town, and have a head of water of twelve or thirteen feet. The water furnishes about 1,600 horse-power, of which only 900 horse-power is used. The cement works have two turbines of 300 horse-power each, making thirty revolutions a minute. A third turbine, of similar action and power, drives an electric dynamo at the rate of 150 revolutions per minute, and thus generates the energy that is to be transmitted to Frankfort. The dynamo is coupled directly with the water motor and produces what is called a 'multiple-phase' or 'rotation' current. This is really a combination of alternating currents. Each of the three components—each of the three constituent currents which, blended together, form the current that is transmitted to Frankfort—has an electromotive energy of 50 volts and 1,400 amperes. The total force, therefore, is 150 volts and 4,200 amperes, or 200 kilowatts. No collector and no brushes are used. Cheapness and simplicity are attained in a remarkable degree. And the working of the whole apparatus is made as safe as that of an ordinary telegraphic battery.

"The line of transmission begins with the falls of the Neckar at Lauffen, and its energy is finally expended in the production of an artificial waterfall at Frankfort. From the dynamo the current is conveyed by means of two brass wire ropes to the transforming machine, passing on the way through a switch-board and automatic power-regulator. The transformer, for perfect insulation, is placed in a tank of oil. It has a capacity of 200 kilowatts, and it transforms the compound low-pressure current, above described into a high-pressure current, having a force of 15,000 volts at twelve or thirteen amperes. And this is the current that is sent forth on the hundred-mile journey to Frankfort. It travels this distance by way of three copper wires, each about four millimetres in thickness. These wires are not covered with any insulating sheath or coating, but are entirely bare. They are carried across the country like ordinary telegraph wires in America, strung along on poles twenty-five feet high and a hundred and twenty-five feet apart. The insulators by which the wires are fastened to the poles are, however, of a special kind. They are made of porcelain, in the usual manner. But on the surface of such insulators moisture is apt to be condensed, thus greatly impairing their efficiency. To prevent this, each insulator is provided with three troughs filled with oil, and thus no fraction of its usefulness is lost.

"Thus the power is conveyed from Lauffen to Frankfort. Here it is received by an oil transformer like that at Lauffen, and is turned into a low-pressure current again of about 100 volts. Then part of it goes to the electric lighting apparatus, and furnishes the current for 1,200 incandescent lamps. The rest of it goes to three motors and there takes the form of mechanical energy. The largest of the three motors drives a huge centrifugal pump, which supplies the stream for the waterfall above mentioned, some thirty-odd feet high. The actual loss of power of transmission is scarcely one-fourth. Therefore, for every 100-horse power of energy sent out from the works at Lauffen, more than seventy-five-horse power is actually available for use in Frankfort, a hundred miles and more away."

CIVIL ENGINEERS' CLUB OF CLEVELAND.

A regular meeting was held at the Club Rooms Tuesday evening, Oct. 9th, with president Gobeille in the chair, and forty-two members and visitors present. Mr. J. Holloway was elected an honorary member and Messrs. W. N. Stair, A. W. Johnston and J. C. Beardsley were elected Active members. Mr. C. M. Barber reported that the prospect for new and more commodious rooms for the club looked very bright and promising.

Prof. C. R. Benjamin made a report on the recent visit of the Club to the works of The Walker Manufacturing Co., describing some of the more novel machines, and some of the large pieces of work now in process of construction at these works. Mr. John Walker also gave a description of some of the large pieces of work, now building for cable railways. He also described the construction of their furnace, by which they are enabled to melt more iron per pound of coke than almost any other furnace of the size in the country. Mr. W. P. Rice gave a report on the Club's visit to the shops and ship yard of the Globe Iron Works Co.

The paper of the evening was by Mr. C. P. Roberts on the Incandescent Electric Lamp from the standpoint of the Electric Light manager and of the customer. He exhibited a number of curves showing the life of the lamp when used with different currents, and the relative cost of lamps of different candle power.

Prof. C. S. Howe read a short paper entitled "A New Method of Calculating Areas in Land Surveying," by which it is claimed that much time can be saved over any of the methods now in use.

Valmorine & Co., of Paris, who made the largest horticultural exhibit at the Paris Exposition, have had a representative in Chicago conferring with Chief Samuels and perfecting arrangements for making a similar exhibit at the World's Fair.

ATMOSPHERIC ELECTRICITY.

The most important recent experiment regarding atmospheric electricity in England, carried out by Mr. Alexander McAdie, seems to take one back to the very infancy of electrical science; for, though the conditions were somewhat different, the operation was substantially identical with Benjamin Franklin's historical experiment with the kite. What Mr. McAdie has demonstrated is that electricity can be drawn from a kite high in the air in a cloudless sky. The kite, Mr. McAdie states, discharged sparks from the lower end of an insulating wire reaching down to the earth, where an electrometer partly measured the increasing electric force. So nearly did the quantity of electricity in the upper air correspond to the height of the kite above the earth that the experimenter could usually determine whether the kite was raising or falling by simply looking at the needle of the electrometer.—*Electrical Engineer.*

AS WE VIEW IT.

It has been well said that "Peace is the dream of philosophers, but war is the history of man." We have the skeleton of an army, and we may reasonably hope that in case of foreign war, as has been the case in the past, the patriotism of the people will induce them to respond to the country's call and enable us speedily to put the army upon a war footing. For several years we have been moving in the direction of building up a navy of modern ships, and we maintain the *personnel* of the navy. We are agitating the question of coast defenses, but with the rapid disappearance of American vessels engaged in the foreign carrying trade, and the decline of the fishing industries, where shall we look for experienced men to man and put the navy on a war footing in case of a foreign war? and with no encouragement for our shipyards, how shall we be prepared to construct the ships required for our merchant marine, in such a crisis? As a matter of national security liberal aid should be extended by the government to promote the restoration of our foreign carrying trade, if for no other reason, to provide a school of instruction for American seamen.—*Marine Journal.*

The owners of one of the finest business corners in Chicago have decided to erect a $1,000,000 sixteen-story building to be called "The Columbus,' in honor of America's discoverer. The plans contemplate a structure strikingly artistic and ornate in appearance, of the Spanish style of architecture On each side of the main entrance will be placed bronze tablet, the first bearing this inscription:

Erected in honor of
COLUMBUS
in the year 1892.
being the 40th anniversary
of the discovery of
America.

The other tablet will show:

CHRISTOPHER COLUMBUS.
Born at Genoa in 1435.
Discovered America the 12th day
of October, 1492.
Died at Valladolid the 20th day
of May, 1506.

It is the intention to have the building completed by May 1, 1893.

A stock company with a capital of $100,000 has been formed to place a paper exhibit at the Columbian Exposition. Every American paper maker or American manufacturer of paper-making machinery will be allowed to take stock. The entire capital has already been secured, but the pledges will not be called for until the outsiders have been given a chance, in order to do away with ony idea of a money-making scheme. A committee of five has been appointed by President M. J. Fitch to take the matter in hand and to send a representative to the meeting of the Boston Paper Trade Club on the third Wednesday in November.

THE WOMEN'S DEPARTMENT.

Women Physicians at the Fair.

The announcement made recently that women physicians will be given official and professional recognition at the Exposition was received with the attention the importance of the fact deserves.

Dr. John E. Owen, medical director of the Exposition, in compliance with a request from the President of the Board of Lady Managers, has promised to place women upon his professional staff, and that they shall in all respects rank equal with men in the Exposition Hospital. This is the most potential result so far, says the Chicago *Tribune*, of the influence of the Board of Lady Managers.

There will also be a model hospital in the Woman's Building. It will be separate and distinct from the official hospital of the Exposition, of which Dr. Owen is director, being rather in the nature of an exhibit. It will, however, be fully equipped with physicians and trained nurses. Adjoining the model hospital, and in connection with it, will be the department of public comfort, which promises to become a novel and important feature of the World's Fair. In this room will be couches and hospital beds for such cases of indisposition or accident as do not require serious or regular medical attention. It is farther contemplated to extend the department of public comfort throughout the entire Exposition by establishing branch rooms in all the main buildings. The Director General has favorably considered a proposition to this effect. All these rooms will be under the management of the Board of Lady Managers.

The Open Switch.

All the summer, early and late,
In the autumn days so drear,
A maiden stood at the orchard gate
And waived at the engineer.
He liked to look at her face so fair
And her homely country dress;
She liked to look at the man up there
At the front of the fast express.

There's only a flash of the maiden's eye
As the engine rocks and reels,
And then she hears in the distance die
The clinkety-clink of wheels.
Clinkety-clink, and a mile apart,
And the fireman seems to hear
The clinkety-clink of the maiden's heart
And the heart of the engineer.

Over the river and down the dell,
Beside the running stream,
She hears the clang of the engine bell
And the whistle's screech and scream.
Clinkety-clink, so far apart
That nothing can she hear
Save the clink of her happy heart
And the heart of the engineer.

Even the trembling steed of steel
Seems to understand
Their sweet distress and answer to
The touch of a magic hand.
Clinkety-clink, so far away
In the twilight dark and drear;
But what does the heart of the maiden say
To the heart of the engineer?

The softening sound of the engine bell,
As the Rogers rolls away,
Seems solemnly to toll the knell
Of the dim and dying day.
Clinkety-clink—there's an open switch—
Oh, angels, hide her eyes!
Clinkety-clink—there in the ditch—
Oh, hear the moans and cries!

Clinkety-clink—and down the track
The train will dash to-day;
But what are the ribbons of white and black
The engine wears away?
Clinkety-clink—oh, world's apart—
The fireman hangs his head;
There is no clink in the maiden's heart—
The engineer is dead.

—*Cy. Warman.*

Aged But Active.

Not long ago Dr. Peables, of Auburn, while making a professional call at the residence of Charles Holbrook, a prominent farmer of North Auburn, learned of the remarkable story of an aunt of Mr. Holbrook, whose death occurred some weeks ago, says the Lewiston (Me.) *Journal*. The aunt's name was Mary Holbrook, and at her decease at the age of ninety-three, she was a widow, living in the town of Holbrook, Mass. She was the mother of twenty-three children and but three were living at the date of her death. She never weighed over one hundred pounds, and in her last days did not weigh over ninety. When seventy-five years of age she began to knit tidies, to while away the time more than anything else, and it was not long until she had over one hundred as the result of her work.

She did not knit the tidies especially for the market, but one day her son took a few samples to Boston, where he found a ready sale for them at Whitney's store, on the corner of Tremont and Winter streets. The tidies seemed to strike Mr. Whitney's customers very favorably, and he was obliged to find the old woman in Holbrook and secure for his store all the tidies she had. Not only this, but he arranged with her to take all she could make at a good figure. She soon found, however, that she could not begin to fill the order, for a certain class of customers at the "Hub" had a regular craze for them. So what did Mrs. Holbrook do but engage several old ladies in the neighborhood to do the coarser parts of the work, filling in the finer parts with her own hands. "In this way," says the writer of Mrs. Holbrook's obituary, "from her seventy-fifth to her ninetieth year, fifteen years, she netted six thousand dollars from the sale of her tidies, upon which fully one-half of the work was done with her own hands. How many ladies over whose silver hairs so many winters have kindly passed can show such a record of almost wonderful patience and perseverance, we wonder."—*Evening Lamp.*

Running a Truck Farm Successfully.

A Massachusetts girl, Mary E. Cutler, has demonstrated that farming in New England can be made to pay. On nineteen acres of land near Holliston she raises vegetables and sells them in the neighboring manufacturing villages. She superintends the work, hires laborers, and keeps her own books. Her vegetables are carried to market in a brightly painted wagon drawn by well fed horses, and she owes much of her success to telling the truth about her stock and filling orders punctually. She has this season a crop of three acres of tomatoes, two of squashes, one and a half of cucumbers, four of potatoes, one-half an acre of asparagus, besides beets, turnips, peas and beans. In addition to her vegetable garden Miss Cutler has an apple orchard and beds of strawberries, blackberries, currents and a greenhouse. Strange to say, Miss Cutler's farm is near Kate Sanborn's "Abandoned Farm." A similar story comes from the west. The daughter of Congressman-elect Baker of the Sixth Kansas District owns a 140-acre farm near Lincoln, works it herself and does not owe a dollar. Her crops this year are abundant.—*Chicago Tribune.*

Women as Pie and Cake Makers.

Fanny H. Rastall, Caroline A. Huling, and Lydia R. Bentley, of Chicago, Ill., have organized the Women's baking company with a capital of $250,000. The company will open its books at once for stock subscriptions. Enough money is now on hand, Mrs. Rastall says, to insure the success of the concern. Pies and cakes will be baked and the factory will be centrally located. Work may begin in a month.

Queen Liliwokalani's Public Spirit.

Queen Liliuokalani, who composed the "Domine Refugium" which was executed at the funeral of the late King of the Sandwich Islands, has now presented the Town of Honolulu with a band of trumpeters, and has started a choir presided over by an English organist.

The Baby Wanted Its Mother.

"When a man has been railroadin' twenty long years
He gets kinder hardened an' tough,
An' scenes of affliction don't trouble him much,
'Cause his natur' is coarse like an' tough,
But a scene that took place on my train one cold night
Would a' melted the heart of a stone,
An' among the adventures which I have been through
That night jist stands out all alone.

"'Twas a bitter cold night, an' the train was jam full,
Every berth in the sleeper was taken;
The people had jist turned in for the night,
An' the tram for New York was a-makin',
When, jist as the people to snore had begun,
An' I with a satisfied sigh
Had sat down in a chair for a short rest, I heard
The sound of a young baby's cry.

"It was one o' those loud, aggravatin' like yells,
O' the pattern that makes you jist itch
For a gun or an ax an' excites up your mind
With wild thoughts o' murder an' sich.
It went through that car, and I needn't remark
That the snorin' stopped right there an' then,
An' that sleeper was filled with a bilin' hot crowd
O' mad women and wild, swearin' men.

"The curtains jist then that concealed berth 16
Were opened an' out come a man,
As fine a young feller as ever I seen,
But his face was all white like an' wan,
He carried the kid that was raisin' the row,
An' commenced walkin' down through the aisle
A tryin' to stop its loud screechin'—but pshaw!
It seemed to get wuss every mile.

"An idea seemed to strike one old feller jist then
An' he said to the pale-faced young man,
"It seems to me, stranger, that kid could be stilled
By a simple an' feasible plan;
The noise that its makin' betrays what it needs—
The child wants its mother, that's plain;
An' why don't you call her? Ten chances to one,
She's sleepin' somewhere on the train.'

"A look then came over that young father's face,
A look full of anguish an' pain;
A look that will haunt me as long as I live,
As long as I work on a train;
An' he answered that man, in a hoarse stifled voice
That sounded as though from afar;
'Her mother is sleeping on board of this train
In a box in the baggage car.'"

—*Maurice E. McLoughlin in the New York Herald.*

How to Paint on Velvet.

The mast artistic manner of treatment is probably that where the design is first painted thinly with oils in subdued colors upon the velvet, and then the requisite effect of light and brilliancy gained by means of metallic or lustra paints. Choose the material with a short, close pile, and select a simple design, writes Maude Haywood in her art department in the *Ladies' Home Journal*. Birds, butterflies, flowers, fruit and scroll-patterns are suitable subjects; but nothing involving minute detail or delicacy of outline should be attempted. Dark backgrounds are the most effective and easiest to manage. The principal difficulty lies in the liability of the oil to spread beyond the tints, forming a greasy halo. To obviate this some recommend squeezing the coloas upon blotting-paper to absorb the oil: others, for the same reason, advise the rubbing of magnesia on the back of the velvet. With care, neither are necessary, but the paints, instead, should be slightly thinned with fresh spirits of turpentine. Avoid matting the pile of the fabric, and let the color of the material show through the tints in tee shadows. Paint rather flatly in soft tones, and remember that the least harshness is particularly fatal. Next outline the design in metallic gald, boldly but carefully, and touch it up with various-colored bronzes, employing soft green shades for the high lights and edges of the leaves, gold for stamens, thorns and, perhaps, tendrils, and whatever tints approach nearest to the colors of nature to enhance the brilliancy of flower or fruit.

Warm Drinks Make Plump Children.

In the course of an article on the care of children in the Philadelphia *Press*, it is said that if mothers want plump children, or desire to round out the figures of scrawny girls and boys, there is a short rule for it. Give them plenty of warm drinks as well as food. This does not contradict the prohibition of sloppy food. To nourish, food must be well ground by the teeth, not washed down. But at intervals of the repast it is grateful to take generous draughts of hot drink. Tempt children to take as much as three cups of drink at each meal. One naturally wants to begin with a hearty draught, another may be well taken at the pause in the middle of the meal, and another if liked at the close. Do not force these things, but have such tempting variety from time to time to time that it is taken without thought. I am quite aware that this is contrary to the general code, but the opinion is framed by wise physicians from close observation.

American Prayers for the Queen.

"The prayers of the righteous availeth much," quoted a genial South Dakotan to the reporter yesterday, prefacing a little story in a manner befitting the day. "The truth of this" he continued, "has certainly a very striking illustration in Yankton. At the Episcopal church in that town finances were a trifle light some time ago, when one of its members visited England, his former home. Well, sir, he actually succeeded there in securing the promise of $1,000 a year for his church upon the condition that it should offer prayer at each service for the Queen of England. The condition is being fulfilled, and the money, I am told, is being paid regularly. You can visit the Yankton church at either the morning or evening service and you will hear prayer offered for the 'Queen of England, the President of the United States, and all others in authority.' This fact is of not a little importance in showing that Victoria thinks South Dakotans are righteous.' She is to be commended for her good judgment."—*Sioux City Journal.*

Women Walk Through Dark Africa.

Three women footed it in July and August last from the Indian Ocean over 200 miles to Mashonaland. They were members of an Episcopal order, and were trained nurses sent out to take charge of the hospital which has been started in that country. The Bishop of Mashonaland expected that provision would be made to carry these young women in hammocks into the interior, but the force of porters was unexpectedly small, and the women said they would endeavor to walk.

With extraordinary courage they set out on the journey. There was no wagon road and for much of the way no paths were found. The party suffered terribly at times from thirst. At night the bush was always alive with lions, hyenas, buffaloes, leopards, and other animals. At one time the party observed two lions drinking quietly thirty rods from them.

The grass often exceeded twelve feet in height for miles and miles, and some days the little caravan marched through incessant rain. They suffered severely from the desertion of their porters, and of the thirty-two carriers with whom they started only four remained at the end of their journey. The women had no tents to sleep in, and altogether they made the journey under conditions which would have tried the strength and courage of the stoutest men. They safely reached their destination, however, and they are the first white women to have made such a journey into the interior of Africa, the others traveling either on steamboats or being carried in hammocks or chairs.

A Woman as a Railroad President.

At a meeting of the directors of the Pennsboro & Harrisville railroad, held in Clarksburg, W. Va., Mrs. Hattie M. Kimball, widow of the late Moses P. Kimball, was elected president of the company. She will assume the duties of the office on January 1. Mrs. Kimball is said to be the first woman ever elected to such a position in the United States.—*Evening Lamp.*

A Young Girl's Room.

A young girl's room may be as full of costly articles as wealth can make it, or it may be the result of taste and ingenuity with but trifling expense, but the one who looks in upon it can, if choosing to take the pains to do so, tell at once the character of the occupant by the mere arrangement or disarrangement of the place. There is, of course, the pretty artistic ensemble that at first glance seems to be only confusion, but which presently resolves itself into a harmony of form and tint, any change in which would be discord, which tells something interesting concerning the artist in the arranger. Then there is the precise and trim manner in which everything is at right angles; every book is exactly in position on every other book; no folderols are allowed; nothing that indicates a waste of time or a love of pleasure; and everything that indicates methodical, utilitarian and exacting traits, with little love of beauty, indicates a character that will by-and-by possibly make life a burden to every one in the house. There is the confusion, again, which is disorder, where everything has been tossed at random; there is no place for anything, and nothing in its place, thus telling a lamentable tale of its first cause. And then there is the abode of neatness without fanatical and pragmatical effort for it, of order without primness, of grace and spotlessness combined; a room where a little of the artist is to be seen, a little of the precision and something of the perfect love of order without its caricature.—*Harper's Bazar.*

Work of Tolstoi's Wife and Daughters.

Tolstoi's eldest daughter, Tatjana, is no adherent to her father's teaching. She is artistic and paints well. The second, Mascha, has chosen her father's mode of life. Dressed as a peasant girl she labors in the fields, and gives her leisure to working and caring for the poor. Countess Tolstoi, notwithstanding the claims of this large family, finds time to attend to her husband's English correspondence. The Count receives letters in four or five languages, and always replies in that in which he is addressed. His daughters help to write the answers. The German letters are dealt with by a young gentleman of that nationality.

As Rosebuds Will.

The dewdrop loved the rosebud, and the rosebud loved the dew,
But the frost king, hoary-headed, came between the lovers true;

Oh, a million jewels brought he, to entice the rosebud sweet,
Ten hundred thousand diamonds, and cast them at her feet.

The dewdrop's tender opals paled before such kingly show,
And the rosebud chose the diamonds, as rosebuds will, you know.

And now? Oh well, the sequel can be whispered in a breath—
She had her hour of splendor, and she paid for it with death.

—By Carrie Blake Morgan, in the *The Ladies Home Journal.*

Tall Girls all the Rage.

It is the fashion for girls to be tall, says Mr. Warner in *Harper's Magazine.* This is much more than saying that tall girls are the fashion. It means not only that the tall girl has come in, but that girls are tall and becoming tall because it is the fashion and because there is a demand for that sort of girl. There is no hint of stoutness, indeed the willowy pattern is preferred, but neither is leanness suggested; the women of the period have got hold of the poet's idea, "tall and most divinely fair," and are living up to it.

Perhaps this change in fashion is more noticeable in England and on the continent than in America, but that may be because there is less room for change in America, our girls being always of an aspiring turn. Very marked the phenomenon is in Europe this year; on the street, at any concert or reception, the number of tall girls is so large as to occasion remark, especially among the young girls coming into the conspicuousness of womanhood.

The tendency of the new generation is toward unusual height and gracious slimness. The situation would be embarassing to thousands of men who have been too busy to think about growing upward, were it not for the fact that the tall girl, who must be looked up to, is almost invariably benignant, and bears her height with a sweet timidity that disarms fear. Besides, the tall girl has come on in such force that confidence is infused into the growing army, and there is a sense of support in this survival of the tallest that is very encouraging to the young.

A Progressive Empress.

"The Empress of Japan," says *Woman*, "takes a keen interest in female education, and devotes all her 'savings' to this object. Every month she visits the school for peeresses at Toki and personally interviews each student and inquires after her progress and well-being. The Japanese girl-students, while eager to embrace our learning, have not copied our costumes and habits, and remain still the quaint, gentle, picturesque musmees of Japan, clad in the many-colored and flowing kimono and gorgeous obi."

Colored Women in Journalism.

Colored women are distinguishing themselves as journalists in America. Among them is Mrs. S. M. Mossell, who is on the staff of the Philadelphia *Times*; Mrs. W. C. Matthews has won reputation as a reporter for a leading New York journal; and Miss Ida B. Willis is a writer of short stories for country newspapers.

Miss Sallie Matthews, the new postmistress at Cloverport, Ky., is an energetic little woman, says the *Evening Lamp.* For six years, though she is still under thirty, she was agent at Cloverport of a large cooperage company, with two hundred men and several steamboats under her control, and she often stood on the hurricane deck of a boat and ordered work done, and at times she was known to stand her watch at the wheel.

Children absorb knowledge in a thousand ways without direct instruction. They are learning from unsuspected teachers, while they seem to be occupied solely with their own little pursuits. The very atmosphere of their home shapes and molds their characters even when there is no formal teaching whatever.

As soon as the babies are old enough to learn anything, teach them to put the playthings in their places. Make them feel ashamed of leaving things for their mother to pick up. It will require patience, far more than to do it yourself and have done with it. The children will be heedless and careless and forgetful. Do not expect to succeed the first time, nor the hundred and first. But perseverance will conquer in the end; your child will acquire the habit of order and be the better equipped by so much for the battle of life. Children can be taught to take pride in keeping their little possessions neat and tidy. The mistake we make in their education is in not giving sufficient weight to the fact that constant repetition is necessary to impress firmly upon their minds anything we wish to teach, and that habits are formed by successive daily acts.—Elizabeth Robinson Scovil, in the *Ladies' Home Journal.*

SEASONABLE ADVICE.

The Herendeen Manufacturing Co., sole makers of the Furman boiler (for steam and hot-water heating), of Geneva, N. Y., have issued a business circular, in which they say:—

It is important at this season of the year, when you are firing up your boiler, to carefully look it over and clean it out.

As you well know, any stove, furnace or boiler will do better work when it is clean than when it is dirty.

We find from experience that, as the majority of our boilers are taken care of by house servants, who are not "professional engineers or firemen" that they do not shake the dust ring regularly every day as we request, and that ashes accumulate between the inside jacket and the tubes forming the fire pot. Hence in order to get the most benefit out of every pound of coal consumed this winter, it is important that the jackets be removed and the boiler cleaned out. It does not require expert work to do this; it can be done under your supervision, by any good mechanic.

Should you find the inside jacket badly corroded, which sometimes happens where the cellar is damp, by all means have a new jacket made by your nearest tinsmith or send to us for one if you desire. Use nothing less than No. 18 black iron for the inside jacket. If you order a jacket of us, be sure to state the size and style of your boiler and the year in which it was bought; also state whether the smoke pipe is attached to the boiler at the bottom or at the top. We will furnish jackets at the lowest wholesale prices as follows:

For inside black iron jacket for No. 5 and No. 6 boilers, $4.00.

For galvanized iron jackets, with asbestos linings, No. 5 and 6, $6.00.

For inside black iron jackets, for No. 3 and No. 4 boilers, $3.50.

For galvanized iron jackets, with asbestos linings, No. 3 and 4, $5.00.

For inside black iron jacket, No. 1, 2 and 2½ boilers, $3.00.

For galvanized jackets, with asbestos linings, No. 1, 2 and 2½, $4.00.

It is also important that the damper box to which the smoke pipe is attached, be thoroughly and carefully cleaned out. On the other style boilers where the damper box is near the bottom of the boiler. a slide can be found on the side of the box, which can be removed and the soot and fine ashes can be brushes out.

By promptly attending to the above, you will probably save several times the expense of cleaning, and the new jackets, if they are necessary, by the smaller amount of coal you will burn this winter.

WORLD'S FAIR NOTES.

John Thorpe, the Floriculture Chief, says that the Columbian Exposition will advance floriculture in this country fully twenty-five years.

A company has been formed, embracing several very wealthy men, to inaugurate and operate in Chicago a permanent circus after the style of the Hippodrome in Paris. A building, with seating capacity of 5,000 and having a garden on the roof, will be erected, and the attraction will be in operation to entertain World's Fair crowds.

Charles W. Rolfe, of the Illinois University, at Champaigh, has been elected to take charge of the relief map of Illinois, which is to be a part of the state exhibit. He will be assisted by a corps of ten engineers, who will go in the field soon. The map is to be made on a scale of one inch to three miles It will be six by ten feet and cost $15,000.

One of the largest bicycle factories in America has written to Chief Smith, of the Transportation Department, that it will exhibit at the Fair "bicycles and tricycles of every style of the trade, showing the rise and progress of the art of making 'wheels,' from the first 'bone shaker' built in this country up to the highly finished 'safety' of the present day."

Chief Ives of the Art Department, now in Europe, writes most encouragingly concerning the prospects of the Art exhibit of the Exposition. He has conferred with artists and art societies in many of the principal cities of Europe and has found them greatly interested in the Exposition, and anxious to send paintings and other art productions for exhibition. He reports his success much greater than he anticipated.

France has asked 25,000 and the Hague 11,000 square feet of space for their picture exhibits alone. Until recently it was thought that the weakest feature of the Exposition would be its fine arts exhibit. Now, however, it is believed that this will be one of the best of all, owing to the fact that European artists recognize in Americans the best purchasers of their work, and they are anxious to take advantage of the exceptional opportunity which the Exposition will offer them to show their paintings to the American people.

October 30 will be "World's Fair Day" at the Texas state fair at Dallas. On that day everyone who owns stock in the Texas World's Fair Association will be admitted free to the fair, and the Association will try to have every visitor buy some of the stock. Texas is trying to raise a World's Fair fund of $300,000 and has already made most encouraging progress. One hundred and sixty-seven counties in Texas have organized for World's Fair work by choosing committees, etc.

All of the restaurants in the Mines and Mining and Electricity buildings will be in the galleries. This was determined in order to leave the ground floor free as far as may be for intending exhibitors. It is thought also that restaurants on the second floors of the building would prove an attractive feature. It was also decided that the restaurants in the Electricity building be located in the two bays at the north end of the hall. In each bay there is to be one large dining-room, surrounded by several smaller rooms twenty-three feet square. The balcony connecting the two is to be fitted up for serving temperance drinks and ices. In the great Manufactures Building about 40,000 square feet have been set apart for restaurants.

Aside from the cost of the great buildings which will be not far from $7,000,000, the following are among the sums which have been or will be spent in preparation of the Exposition grounds: Grading and filling, $450,000; landscape gardening, $323,500; viaducts and bridges, $125,000; piers, $70,000; waterway improvements, $225,000; railways, $50,000; steam plant, $809,000; electric lighting, $1,500,000; statuary, $100,000; vases, lamps, etc., $50,000; lake front adornment, $200,000; water supply and sewerage, $600,000; other expenses, $100,000; total $5,943,500. The total expense of organization, administration and operation of the Exposition is estimated at nearly $5,000,000. This takes no account of the sums to be spent by the government, the states or foreign nations.

BUSINESS NEWS.

The following letter speaks for itself:—

We are pleased to advise you that we have secured the services of Mr. Jos. H. Springer, now with the Niles Tool Works, at Hamilton, Ohio, to fill the position of general manager of our works, made vacant by the death of Mr. Bruno Fritsch.

Mr. Springer besides being a mechanical engineer of recognized ability, is a man of extensive practical experience and thoroughly abreast of the times, having for the past seven years occupied a similar position with the above company, whose growth and success are largely due to his energy and excellent management.

Mr. Springer will have full control of our shops with the valuable assistanoe of James R. Livingstone, our present superintendent.

We have recently made extensive improvements of various kinds, and added to our facilities several important tools of the latest design, altogether rendering our works as complete as any in the West, and equal to any requirements that may offer.

Thus equipped we feel confident of our ability to execute with promptness and satisfaction all orders with which we may be favored, and with due appreciation of patronage heretofore enjoyed, we solicit a continuance of your confidence and support.

Very respectfully,

Ranken and Fritsch Foundry and Machine Co.

2201 Main St., St. Louis, Mo.

Map of the United States.

A large, handsome map of the United States, mounted and suitable for office or home use, is issued by the Burlington route. Copies will be mailed to any address on receipt of 12 cents in postage by P. S. Eustis, Gen'l Pass. Agent, C., B. & Q. R. R., Chicago, Ill.

CONTRACTS OPEN.

Engineers.—Everywhere to know that I have now completed the publication of "Stepbenson's Illustrated Practical Test," which lays over every other work on questions and answers in print; latest examinations for state, city or government license; well illustrated, nicely bound in cloth; agents wanted; sent by mail for $1. Walter G. Kraft, 44, 70 La Salle street, Chicago.

Water-Works Franchise.—The city of Cape Girardeau, Mo., desires to let a franchise to a private company to build and operate water-works. Plans and specifications are now on file with the undersigned, and with Johnson & Fladd, consulting engineers, Laclede Building, St. Louis. Sealed proposals will be received up to 6 o'clock p. m., Monday, the 7th day of December, 1891.

Other systems will be investigated, if submitted.

The Mayor and Council reserves the right to reject any or all bids. H. P Peiromut, Mayor. Attest. Geo. E. Chappell, City Register.

Sealed Proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock p. m. on the 30th day of November, 1891, for all the labor and materials required for the cut stone work and brick work, iron and wood floor and roof construction, roof covering, approaches, etc., for the superstructure, ready for the interior finish of the United States Court House and Post Office, at Springfield, Missouri, in accordance with the drawings and specification, copies of which may be had at this office, or the office of the Superintendent at Springfield, Missouri. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in an envelope, sealed and marked, "Proposals for the Cut Stone Work and Brick Work, Iron and Wood Floor and Roof Construction, Roof Covering, Approaches, etc., for the Superstructure, etc., ready for the interior finish, for the United States Court House and Post Office at Springfield Missouri," and addressed to W. J. Edbrooke, Supervising Architect.

Proposals.—Sealed proposals will be received at the office of the Illinois Board of World's Fair Commissioners, Room 18 Montauk Building, in Chicago, until 12 o'clock m. on the 18th day of November, 1891, for all the labor and material required for the erection and completion of the Illinois Building for the World's Columbian Exposition at Chicago in accordance with the drawings, general instructions, conditions, and specifications (copies of which may be seen at the office of the Commissioners in Chicago and on application to the architects, W. W. Boyington & Co., 157 La Salle street, Room 107, on and after Oct. 26, 1891.)

Each proposal, whether for a part or the whole of the work, must be accompanied by a certified check for a sum not less than 3 per cent of the amount of the proposal, drawn in favor of the Director-in-Chief of the Illinois Board of World's Fair Commissioners.

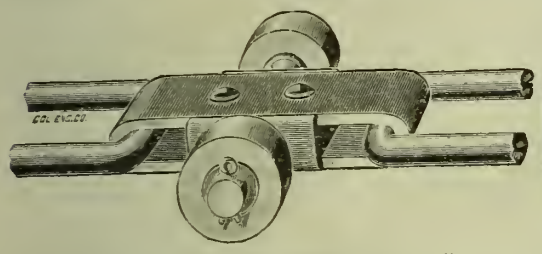
The Commissioners will reject all bids received after the time herein stated for opening the same, also bids which do not strictly comply with all the requirements of this invitation. The Commissioners also reserve the right to reject any or all bids. Proposals must be inclosed in sealed envelopes, including schedule of work and material and check, and marked "Proposal for the Illinois State Building for the World's Columbian Exposition," addressed to John P. Reynolds, Director-in-Chief of the Illinois Board of World's Fair Commissioners. This 15th day of October, 1891. W. C. Garrard, Secretary Illinois Board of World's Fair Commissioners.

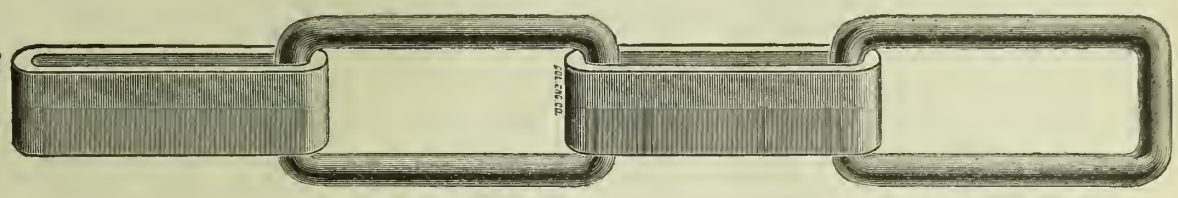
NOVEMBER 14, 1891. **The American Engineer.** VOL. 22, NO. 20.

THE JEFFREY WROUGHT CHAIN BELTING.

The accompanying long cut, on the upper part of this page, shows the style of the Jeffery wrought link belting, made of iron or steel, by the Jeffery Manufacturing Co., of Columbus, Ohio. The other cuts represent the attachments for the same; the one parallel with the belting cut being the carrier. The uses of the others are apparent from their appearance.

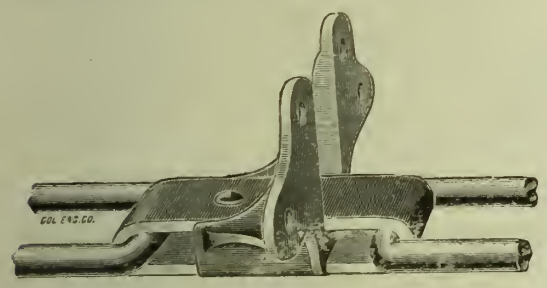
An illustrated catalogue of this belting, and attachments, may be had from the manufactory at Columbus, O.), or from Mr. J. H. Gregg, manager of the company's Chicago office, 48 South Canal street, Chicago.





In offering this style of belting the Jeffrey company do so with the full insurance that it will compare favorably with any wrought iron or steel cable chain belt made, in quality, efficiency and cost. It is superior to any form of cable chain that is made to work on sprocket wheels, in that the links have greater wearing surface, (consequently longer life,) and for conveying or elevating machinery are firmer, in that the coupling holds the links and attachments rigid and in line.

The links are made of best quality iron or steel. The round bar link is made square at the ends to



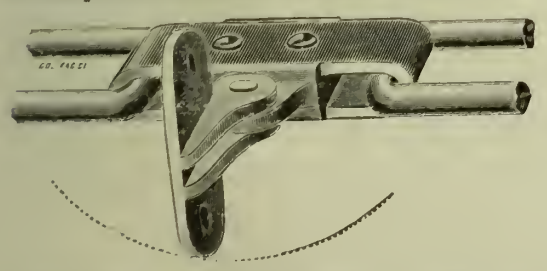
conform to the coupling links, which makes a wearing surface equal to the width of the coupling link.

The coupling links admit of attachments as shown herewith. These are made so as to give strength equal to the work intended to be performed.

A special coupling link is provided with each section of chain, so that connections can be made as in the detachable chains.

REVOLUTIONARY EFFECTS OF MACHINERY.

The women of Chicago and other American cities have been in the habit of buying large quantities of cheap cotton embroideries, made principally in



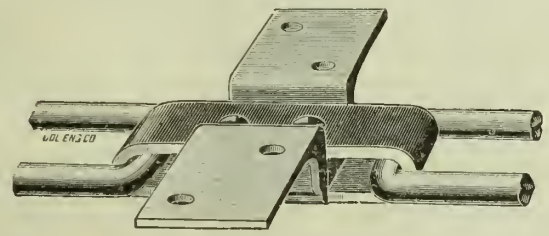
Switzerland. The United States bought eight million dollars' worth of these goods last year from that country alone. The price of these embroideries has advanced somewhat of late, the duty which they pay being 60 per cent of their value at the place of manufacture, while it used to be but 30 and 40. There is a prospect, however, that within a short time prices will fall below what they were, owing to the successful introduction of steam embroidery machines by a Swiss manufacturer.

At present all these goods are made on hand machines, of which there are over 23,000 in use in a small district in Eastern Switzerland. Each of them requires the labor of two persons, the most highly skilled of whom—the embroiderer—does not earn over 50 cents a day. Owing to the cheapness of the labor no attempt has been made to introduce this industry into this country. The tariff duty was not raised for protective purposes, but simply to get more revenue to help pay the sugar bounties. On the basis of last year's importation the Treasury would get $4,800,000 from this one item of cotton embroideries. The sugar bounties will extract about 12 millions from the Treasury.

A steam embroidery machine has now been invented which will produce from 12,000 to 15,000 stitches daily, with one attendant, while two hand machines with four people to run them can produce but 5,500 stitches. It is true that the steam machine costs $1,600 while the hand machines costs $400, but in spite of this difference in the amount of capital invested the cost of production will be so lowered that the cost of the goods will fall decidedly.

The 23,000 machines now in use give employment, such as it is, to about 60,000 persons. If they are thrown aside what will become of many of those who are running them now? They will either have to go to work on finer grades of embroidery, where the competition of steam cannot follow them, or will have to learn some other business, which is not so easy a task in a country where other trades are already filled.

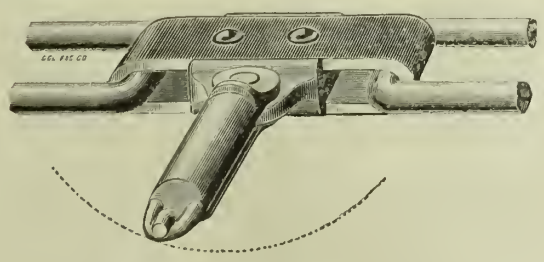
In this case, as in some others, the introduction of machinery, while causing great and permanent



good, is attended with some temporary inconvenience on the part of a few.

The United States is interested in this invention to this extent: If these cheap embroideries can be made on steam power machines there is no reason why they should not be made in this country and a new industry be established in the United States. That is impossible as long as the goods are made by men who get but 50 cents a day.

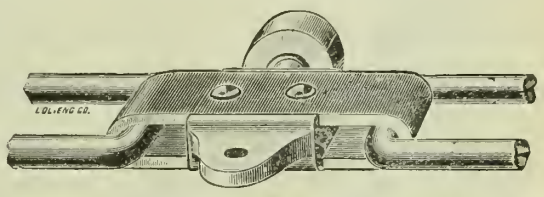
But if the work can be done by nearly automatic machines the labor cost of the embroideries will be much less and competition between Swiss and American manufacturers will become possible, for the difference in the wage scales of the two countries will be of less consequence.—*Chicago Tribune.*



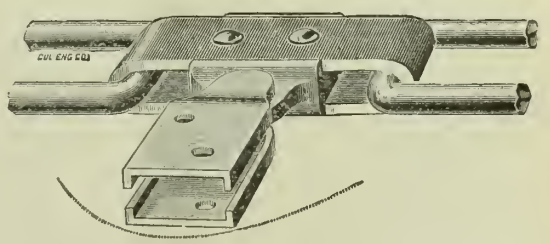
PAINT FOR EXPOSED METAL.

Red lead, so largely used by engineers, is an oxide of lead, usually in the form of bright red powder, which is not affected by water, but evolves the smell of chlorine when boiled with hydrochloric acid, and is slowly converted into chloride of lead. Dilute nitric acid only partly dissolves it, leaving a brown powder. On account [of its durability it is frequently used as a priming coat, often the only coat used on iron work. Care should be taken that no salt is present, otherwise a chemical action commences, blisters are formed, and the lead is reduced to a metallic condition. It has been proposed to substitute for red lead a lead obtained from a sulphide of antimony, termed antimony vermillion, which is sold in a state of very fine powder, without taste or smell, and which is insoluble in water, alcohol, or essential oils. It is but little acted on by acids, and certain engineers state that when ground in oil it acquires great intensity or brightness of color, that it has a good body, is unalterable by air or light, and may be freely mixed with white lead. Black paints made from the residual products obtained in distilling coal and shale oils are largely employed for rough work. They combine readily with drying oils, and give an intense and handsome black, which is at the same time very economical. Native oxide of iron has of late years supplied us with a paint which possesses many of the good qualities of red lead without its inconveniences. Oxide of iron paints are most effective and durable paints to use on iron, as they have no tendency to change or effect the surface of the metal. An analysis of one of these paints give peroxide of iron 68.95; aluminous earth (clay), 1.48; burnt clay, 29.57; total 100. The purple brown oxide is a hydrated peroxide of iron.

Under equal volumes iron paints cover more than those from lead; mixed with one-third of white lead it forms an excellent mastic, similar to that made from red lead, and which becomes very hard after drying for some time. As the iron oxide of paint resists a strong heat, it is advantageously employed for painting parts of machines and boilers. The so called anti-corrosive paint is made of equal



parts by weight of whiting and white lead, with half the quantity of very fine sand or road dust, with colors at pleasure. The [illegible]e being made with water can be used as [illegible]or, but it is usually applied as an oil pa[illegible]. The preparation of oil recommended for this purpose is twelve parts by weight of linseed oil, raw; one part of boiled linseed oil, and three parts of sulphate of lime, the whole well mixed. One gallon of oil thus prepared is used to seven pounds of the paint. Paints containing silica have been used for both wood and iron; they give a hard substance which is very durable; it is stated that when mixed with proper oils they will resist the action of salt water or acids better than iron or lead paints, that they cover well, and that in case of wood they form a considerable protection against fire.—*Gas Fitters' Review.*



Acting Secretary of State Wharton has issued an order to all diplomatic officers of the United States, instructing them to use their influence to have all cuts and lithographs sent out free to boom the Exposition admitted into foreign countries free of duty. This order was issued because the admission of such cuts, etc., duty free, has been refused by some countries, and in consequence, the desire to give the Exposition the greatest possible publicity is interfered with.

Hassan Ben Ali, of Morocco, is seeking a concession to make a Morocco exhibit at the Exposition. He says he will spend $50,000 in showing the people, manners, customs, amusements, etc., of his country, and in bringing to Chicago a tribe of Berbers.

BAIN'S SMALL ELECTRIC LIGHT PLANTS.

The rule, until lately, has been that electric plants—whether for light or power purposes—must be operated on a large scale to make them pay. And practical applications of electricity did not gain public favor until they were reduced to a paying basis. And, as just intimated, small electric light plants were out of the question—on account of dollars and cents—until recently.

Now we have the pleasure of introducing to our readers a system of electric light service which may be economically adapted in isolated residences, or wherever a small plant may be desirable. As a contemporary observes, the services of electricity for the generation of light and the utilization of power may be had without the intervention of electric companies to supply the electricity from a central station.

The pioneer in the application of electricity in "small quantities" is Mr. Foree Bain, of the Bain Electric Manufacturing Co., of Chicago. Mr. Bain is one of the leading practical electricians of America, and of the world, as far as that goes. He was (and is) the consulting electrical engineer of Col. Lowry's great electric railway systems of Minnapolis and St. Paul, Minn., and other important electrical undertakings; while in Chicago he is looked up to by hosts of people who are using electricity for various purposes. His services have been in requisition by hundreds of manufacturers who have adopted isolated electric plants. And problems of the latter kind have inspired Prof. Bain to perfect a system of small plants, to enable those who desire electric light, or electric power, on a small scale, so to speak, to get what they want in a way that will pay.

Full particulars are given in a pamphlet, entitled "Bain's Complete Electric Light Plants," which will be sent free to anyone desiring it. In their introduction, the Bain Company say: "If you have been contemplating the use of electric light, and have hesitated to purchase on account of the unreasonable prices that have hitherto been charged, we think you will agree with us if you will kindly read this pamphlet, that we have solved the problem." And not only that, but the Bain electric plants "are as easily put up and set in operation as an electric door bell, and with the instructions and illustrations sent (with each plant) they cannot be put up wrong."

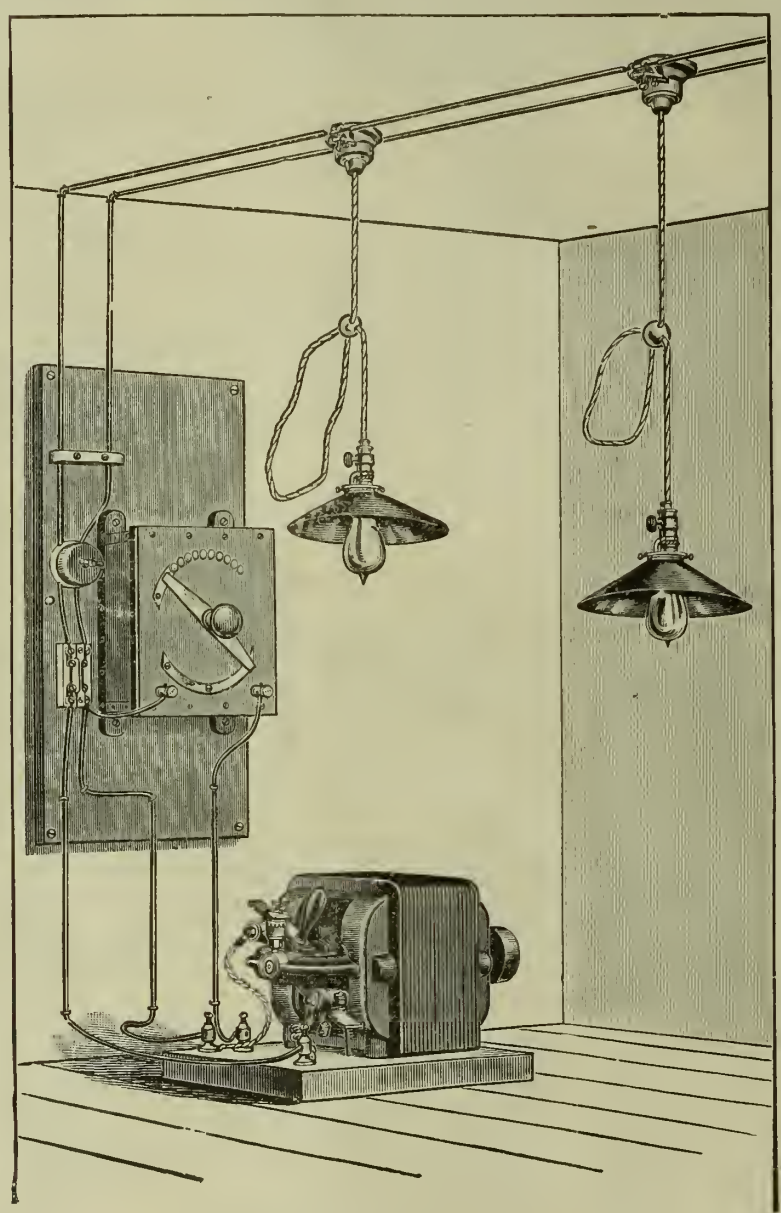
The illustration given herewith shows one of the Bain little plants connected and ready to produce light when set in motion. A complete plant, to supply 5 electric lights, would cost only $97.75, the details being as follows: Dynamo, $75, regulator, $5; five 16 candel-power lamps, $3.75; five key sockets, $3.75; five bushings, 25c.; five shades, $1.25; five shade holders, 75c.; five rossette and fuses, $2; thirty feet of drop cord, $1; five adjustable clamps for drop cord, 25c.; a double-pole switch, $1.50; a double-pole fuse base, 75c.; and a switch board wired, with wire, cleats, screws, etc., $2.50; total $97.75.

There will be required, in addition to these electrical fittings, a small gas engine or water-motor (which can be provided at very little expense) or some other means of obtaining the initial force. The pamphlet referred to contains a tabulated price list of dynamos and appurtenances to produce 10, 15, 20, 35, or 50 lights (of 16 candel-power each). And the cost of electric light, by means of these convenient plants, is much less than what is paid for gas, that is in the "long run"—and not a very long one either. For instance, a plant for 15 beautiful electric lights, including water-motor or gas engine to operate it, would cost about the same amount as is paid for 15 comparatively dingy, blinking, unhealty gas lights for 21 months, or say two years at most. Afterwards the electric light is "all profit" almost.

To state the case in other words we will say, as an example, that a house may be supplied with 15 electric lights (16c. p. each), by the Bain plant No. 3, at a cost of about $225, including water-motor and all fittings and connections. If the water used has to be paid for, that is all the cost, except the supply of new lamps when necessary (at the rate of about 75 cents each from the Bain company, but which cost only 50 cents each from the Edison company if they will fit). The cost of operation is thus extremely small. And the serious expense of an electric plant is at the start. And if used for only a year, or so, gas costs less; if for two years, gas and electricity cost about the same; but if the service is extended over four or five years, the cost of 15 good electric lights will be about one-half the payments made for 15 gas jets, during such a period.

The trouble with the electric companies is that they have too many fortunes to make. The Bain plants are fairly reasonable—very much lower than anything similiar on the whole electrical market, as far as we are aware. And yet there remains a great margin for profit. Take the price of lamps, for instance, in the Bain list five of them cost $3.75, that is 75 cents each, whereas the Edison lamps cast only a half a dollar a piece, buying one at a time—if bought in dozens they come to only 44 cents each. This shows (if the other charges are on the same scale) that the Bain plants afford a rattling good profit.

Let us be thankful for small concessions. The



Bain's Small Electric Light Plant.

Bain Electric Manufacturing Co., whose goods are first-classs, it must be admitted, have brought the prices of useful electric plants down within reasonable limits. Further great "drops" may reasonably be expected in the near future. When another respectable firm comes forward, to undersell the Bain people, while maintaining excellent quality, then a healthy competition may be expected to set in.

Electricity will not have fair play (as far as dollars and cents are concerned) until the mute monopoly that has hitherto ruled prices in the electrical market is broken. When it becomes subject to ordinary competiton, it may be expected with good reason that electric light and electric power may become as general as water and as popular as politics. Families will then vie with each other, probably, in the electrical displays of light and energy at each house.

Such a condition of things is almost in sight, as it were. And it only requires the awakening of the spirit of free competition, in a few leading electricians, to throw off the reserve which now keeps prices a long way up. The Bain company have made a forward step in this direction. There is yet plenty of room to go ahead of them, lowering prices, and yet keeping up quality and efficiency.

THE QUEEN OF UNCLE SAM'S NAVY.

The armored cruiser "New York," which is to displace the cruiser Philadelphia as queen of the United States Navy, will be launched from Cramp's shipyard on Tuesday, December 1. High water on that day will be about 1:30 o'clock in the afternoon, and at that hour the sole piece that holds the largest vessel in the United States Navy on the stocks will be cut.

The cheer that will go up from thousands of throats and the scream of whistles that will salute her as she floats out on the Delaware will be in honor of the largest vessel ever built in America.

The tonnage of this great vessel is 8,150. She is 380½ feet long, 64 feet beam, and will draw 23 feet of water. Her speed is to be 20 knots an hour and her indicated horse power is to be 16,000. Her tonnage will be exceeded by that of the new battle ships and her horse-power by the new fast cruisers Nos. 12 and 13, all of which are under construction, but until fast cruiser No. 12 is completed she will have no peer.

"She is the type of the British warship Blake," said Charles H. Cramp "with side armor."

Invitations to be present at the launch will be issued about the middle of the month, to about 200 persons. These will include President Harrison and his Cabinet, the heads of the bureaus of the Navy Department and prominent naval officers. As the new vessel is named after the Empire state and the metropolis of the nation, a hundred guests will be present from New York State and New York City.

Governor Hill and other state officials, Governor-elect Flower, Mayor Grant, of New York, and the chief officials of the city, and the editors of the leading New York papers will be invited.

Work on the vessel is as far advanced as is usual with a new ship at launching time. The port shaft is in place, and the starboard shaft in its bearings. Preparations for the launch go on as rapidly as necessary. The frame work of a platform at the bow for some of the guests has been erected.

Work on cruiser No. 12 and the battle ships Indiana and Massachusetts, is progressing rapidly and the keel of the cruiser No. 13 will be laid soon after the New York leaves the ways.

The following petition, addressed to the Congress of the United States, is being extensively circulated for signatures:

"The undersigned citizens of the United States, having a profound sense of the evil and inadequacy of war as a mode of settling international disputes, hereby pray your honorable body to take whatever action may be necessary to invite a conference of the governments of the world to sit, during, and in connection with, the World's Columbian Exposition, to be held in Chicago in 1893, for the purpose of devising, discussing and recommending measures by which the principal of arbitration may be incorporated into treaties, conflicting international laws may be harmonized, and an international court established, having jurisdiction in cases which goverments shall fail to settle by negotitation."

The upholsterers of Philadelphia have applied for 50,000 square feet of space in the Manufactures Building, for a collective exhibit from their several establishments, at the Columbian Exposition.

LOCALIZATION AND REMEDY OF TROUBLES IN DYNAMOS AND MOTORS.—VII.

By Prof. Francis B. Crocker and Dr. S. S. Wheeler.

Continued from Page 180.

VII.—MOTOR STOPS OR FAILS TO START.

This trouble is, of course, an extreme case of the previous class (Speed to High or Low), but it is made a separate class because it is so perfectly definite and requires somewhat different treatment. This heading does not, of course, apply to dynamos since they are usually driven positively by an engine and do not, like a motor, depend on their own operation for their motion.

1st Cause.—*Great Overload.* (See Sparking, No. 1.) A slight overload causes motor to run slowly, but an extreme overload will, of course, stop it entirely or "stall" it.

Symptom.—On a constant current circuit no harm results, and motor starts properly when load is reduced or taken off.

On a constant potential circuit the current is very excessive, and safety fuse melts, or, in the absence or failure of the latter to act, armatnre would be burnt out.

REMEDY. — Turn on switch instantly, reduce or take off the load, replace the ruse or cnt-out if necessary, and turn on current again, jnst long enough to see if tronble still exists.

2nd Cause.—*Very excessive friction due to shaft, bearings or other parts being jammed, or armature touching pole pieces.*

Symptom.—Similar to a previous case, but is distinguished from it by the fact that armature is hard to turn by hand, even when load is taken off. Examination shows that shaft is too large, bent or rough, or bearing too tight, armature touches pole pieccs or other impediment to free rotation.

REMEDY.—Turn current off instantly, ascertain and remove cause of friction, turn on current again just long enough to see if trouble still exists.

3rd Cause. —*Circuit open* due to (*a*) safety fuse melted, (*b*) wire in motor broken or slipped out of connections, (*c*) brushes not in contact with commntator, (*d*) switch open, (*e*) circuit supplying motor open, (*f*) failure at generating station.

Symptom.—Distingnished from Nos. 1 and 2 by the fact that if load is taken off motor still refuses to start, and yet armature turns freely by hand.

On a constant current circuit the switch arcs badly when turned on if motor circuit is open; but there is no current, motion or other effect in motor. On a constant potential circuit, field circnit alone of a shunt motor may be open, in which case pole pieces are not strongly magnetic when tested with a piece of iron; if armature circuit is at fault there is no spark when brushes are lifted, and if both are without current there is no spark when switch is opened.

REMEDY.—Turn current off instantly. Examine safety fuse, wires, brnshes, switch and circuit generally for break or fault. If none can be found turn on switch again for a moment, as the trouble may have been due to a temporary stoppage of the current at the station or on the line. If motor still seems dead, test separately armature, field coils and other parts of circuit for continuity with a magneto or cell of battery and electric bell. (See Instructions for Testing.)

4th Cause. — *Wrong connection, or complete short circuit of field, armature or switch.*

Symptom.—Distinguished from Nos. 1 and 2 in the same way as No 3, and differs from No. 3 in the evidence of strong current in motor.

On a constant potential circuit, if current is very great, it indicates a short circuit. If the field is at fault it will not be strongly magnetic.

The possible complications of wrong connections are so great that no exact rule can be given. Carefully examine and make sure of the correctness of all connections (see Diagrams of Connections). This trouble is usually inexcusable, since only a competent person should ever set up or change the connections of a motor.

To be Continued.

FALLS RIVET AND MACHINE CO.'S STEEL RIM PULLEYS AND CLUTCHES.

The accompanying cuts show (1) a six-arm clutch on a patent steel rim pulley, (2) a four-arm friction clutch cut-off coupling, and (3) a six-arm bare pulley.

That the Falls Rivet and Machine Co. claim their pulleys to be the best in the market goes without saying, but the reasons therefor are worth noticing, namely—

That they are all made "running balance."

That they are from 25 to 40 per cent. lighter than corresponding sizes of ordinary cast iron pulleys, but are much stronger and capable of transmitting fully fifteen per cent. more power.

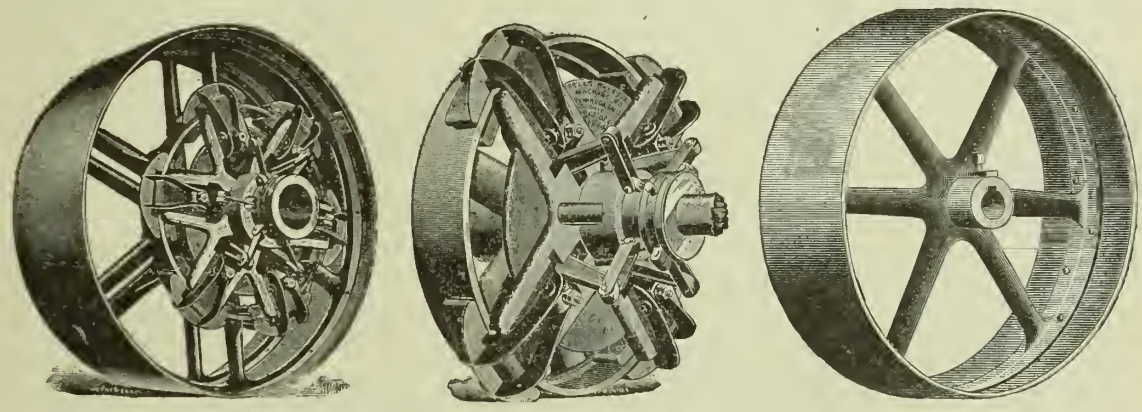
That the saving in weight is principally made in the rim, where, for several reasons, lightness is most desirable.

That the rims being made of rolled steel cannot be chipped while in transit to destination, or broken by accidents in handling that would ruin an ordinary cast pulley.

That the continuous cast iron inner rim (connecting the outer ends of the pulley arms) effectually preserves the pulley's perfect roundness, no matter how tight the belt or how high the speed at which it may be run.

That the steel rims are so securely riveted to the supporting cast rims that they cannot possibly work loose, it is said.

The above points of superiority, which give a pulley that is especially desirable for high speed service, will be thoroughly appreciated by millwrights, machinists and manufacturers generally. The pulleys have made fast friends of all who have become acquainted with them, say the manufacturers, and their sale is increasing rapidly.



Falls Rivet and Machine Co.'s Steel Rim Pulleys and Clutches.

Some of the largest electrical plants in the country, we are informed, have been fitted with the above-mentioned pulleys and friction clutches.

The Chicago Shafting and Pulley Co., 10 South Canal St., Chicago, are selling agents for the above.

The alkaline accumulator devised by MM. Commelin Desmazures and Bailhache, according to the London *Electrician*, has recently undergone a small improvement in detail, which will tend to diminish the somewhat excessive loss of charge when left on open circuit which was noticeable in the earlier types. A battery of these cells, weighing 21,650 pounds, is used on board the marine boat Gymnote, and it has been found possible to obtain from this battery, without injury to it, no less than 345 horse-power, or one horse-power per 63 pounds of dead weight. A battery of these cells was also employed to operate a Canet cannon during the Paris Exposition last year. The Commelin-Desmazures accumulator contains, it will be remembered, compressed porous copper negatives (2 to 3 millimetres thick), inclosed in an envelope of parchment cloth and iron wire gauze positives, in a 50-degree Baume solution of zincate of potassium. During the charge zinc is deposited upon the iron electrodes and oxygen is absorbed by the copper electrodes. During the discharge the zinc is redissolved, combining again with the oxygen from the copper electrode. The average E. M. F. per cell is only .75 volt. It was found that the parchment cloth became feebly conducting after long immersions in the electrolyte and in consequence there was considerable loss of charge on open circuit. The cells are now constructed with the parchment cloth carefully insulated from the copper plates.

ENGINEERS' CLUB OF PHILADELPHIA.

At the last meeting of the Engineers' Club of Philadelphia, Captain Spencer C. McCorkle presented the following resolution:

Resolved, That the President be requested to appoint a Committee of three to propose measures for bringing the subject of Landlocked Navigation before the Boards of trade and other commercial bodies of the principal Eastern and Southern seaboard cities, with the view of preparing a joint memorial for presentation to Congress, urging the importance of the subject and praying that the necessary preliminary steps be taken in that direction. He urged the necessity of interesting the various boards of trade and other commercial bodies in the project of perfecting the interior lines of water communication along our Eastern and Southern coasts, and then bringing the matter to the attention of Congress. The resolution, seconded by Mr. Trautwine, was adopted. The Chair subsequently appointed Capt. McCorkle and Messrs. Foster Crowell and Rudolph Hering as the Committee.

Hon. B. E. Fernow, Chief of the Forestry Division of the Department of Agriculture, described the tests of timber now being made under the auspices of that Department and urged the necessity for them. The material is to be collected under the direction of experts, and all the data are to be carefully noted, so that not only the section from which the specimen is obtained will be known, but also the entire history of each piece tested.

Expert engineers are working upon the drainage problem in connection with the Exposition grounds at Jackson Park. As a result of calculation in the Construction Department, a somewhat new plan will be adopted for taking care of World's Fair sewage. All the offal, conveyed through underground pipes, will run into four large tanks at the southwestern portion of Jackson Park. These tanks are to be thirty feet in diameter and forty feet deep. The novel feature connected with the plan is that the sewage deposited in the tanks is to be treated chemically, and the Construction Department believes that the water flowing from them after the chemical treatment will be almost pure and wholesome. So far as is known a similar treatment has never been adopted, except at Berlin, Germany. There the method has been found to work with satisfaction. If equally successful at Chicago the waters of the lake will not be polluted by the drainage from the Exposition grounds.

Electricity is to be the motive force in Jackson Park during the construction of the Exposition buildings. The Electric plant has been completed and steam engines must go. This is done in order to reduce the fire risk. The saw-mills, used in getting out building material, which have been run by steam, are now supplied by electric power, furnished, if desired, night and day. Electrical Engineer Sargeant is prepared with a sixty horse-power plant to supply electric-motor service.

British Guiana has appointed its Royal Agricultural and Commercial Society a World's Fair Commission to represent the Colony, and has appropriated $20,000 for an exhibit. President B. Howell Jones, of the Commission, has been made its executive officer. A space of 60x30 feet has been requested near that assigned to the Dominion of Canada and other British-American colonies, so that a contrast may be made between their exhibits and those of the Latin-American countries.

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CONTENTS OF THIS NUMBER.

ENERGY is a great mystery to a man like Thomas A. Edison. The "Wizard" also considers that "all matter lives and possesses intelligence." Hitherto it is only poets, and only the most inspired ones, have perceived animation in dust. In the next column we give an extract of Mr. Edison's views regarding energy, which are thoroughly Edisonian.

COMBUSTION of coal under a boiler is a very common process, to the ordinary mind; but to those who have studied the subject, it affords much food for reflection. What Mr. Edison says in reference to the many forms of energy that result therefrom, as quoted in this issue, cannot fail to be of special interest to those who have studied fuel economy. And Mr. Edison's remarks point out that men have no idea yet as to what combustion is capable of.

WIVES of stationary engineers are discussing the question of joining the Daughters of Fulton, and instituting auxiliaries, all over the country. In this issue the Supreme Secretary, Miss May E. Deas, blows the bugle of organization. Bro. Eben B. Hill shows that the elevating influence of good women have told on him, and he will do all he can to lead the engineers' wives and daughters in Missouri to join the Daughters of Fulton. We are not at liberty to report what is being done in reference to the matter in Omaha and other cities. The spirit of progress is moving, however, in various directions. And we are glad that our Women's Department is being apprcciated and likely to become very useful. An old adage says that a man becomes pretty much what a woman makes of him. Here is an opportunity.

VITAL ENERGY AND ELECTRICITY.

The great electrical inventor, Thomas A. Edison, has spoken his mind, it seems, touching energy, as follows:

"Of course there is a source of energy. Nature is a perpetual motion machine, and perpetual motion implies a sustaining and impelling force.

"When I was in Berlin I met Du Bois Reymond, and, wagging the end of my finger, I said to him, 'What is that? What moves that finger?' He said he didn't know; that investigators have for twenty-five years been trying to find out. If anybody could tell himwhat wagged this finger the problem of life would be solved.

"There are many forms of energy resulting from the combustion of coal under a boiler. Some of these forms we know something about in a practical way, but there may be many others we don't know anything about.

"Perhaps electricity will itself be superseded in time, who knows? Now a beefsteak in the human stomach is equivalent to coal under a boiler. By oxidization it excites energy that does work, but what form of energy is it? It is not steam pressure. It acts through the nerve cells, performs work that can be measured in foot pounds, and can be transformed into electricity, but the actual nature of this force which produces this work—which makes effectual the mandate of the will—is unknown.

"It is not magnetism; it doesn't attract iron. It is not electricity—at least not such a form of electricity as we are familiar with. Still, here it is necessary to be guarded, because so many different forms of electricity are known to science that it would be rash to say positively that we shall not classify vital energy as a form of electrical energy. We cannot argue anything from difference in speed. Nerve force may travel as fast as electricity once it gets started. The apparent slowness may be in the brain. It may take an appreciable time for the brain to set the force going.

"I made an experiment with a frog's leg that indicates someting of the kind. I took a leg that was susceptible to galvanic current. The vibration produced a note as high as a piccolo. While the leg was alive it responded to the electrical current; when it was dead it would not respond. After the frog's leg had been lying in the laboratory three days I couldn t make it squeal. The experiment was conclusive as to this point.: The vital force in the nerves of the leg was capable of acting with speed enongh to induce the vibration of the diaphragm necessary to produce sound.

"Certainly this rate of speed is much greater than physiologists appear to allow, and it seems reasonable that there is a close affinity between vital energy and electricity. I do not say they are identical; on the contrary, I say they are very like. If one could learn to make vital energy directly without fuel, that is, without beefsteak in the stomach, and in such manner that the human system could appropriate it, the elixir of life would no longer be a dream of alchemy. But we have not yet learned to make electricity directly, without the aid of fuel and steam.

"I believe this is possible; indeed, I have been experimenting in this direction for some time past. But until we can learn to make electricity, like nature, out of disturbed air I am afraid the more delicate task of manufacturing vital energy so that it can be bottled and sold at the family grocery store will have to be deferred.

"Electricity, by the way, is properly merely a form of energy and not fluid. As for the ether which speculative sience supposes to exist, I don't know anything about it. Nobody has discovered anything of the kind. In order to make their theories hold together they have, it seems to me, created the ether. But the ether imagined by them is unthinkable to me. I don't say I disagree with them, because I don't pretend to have any theories of that kind and am not competent to dispute with speculative scientists. All I can say is, my mind is unable to accept the theory. The ether, they say, is as rigid as steel and as soft as butter. I can't catch on to that idea.

"I believe that there are only two things in the universe—matter and energy. Matter I can understand to be intelligent, for man himself I regard as so much matter. Energy I know can take various forms and manifest itself in different ways. I can understand also that it works not only upon, but through matter. What this matter is, what this energy is, I do not know.

"However, it is possible that it is simple matter and energy and that any desire to know too much about the whole question should be diagnosed as a disease; such a disease as German doctors are said to have discovered among the students of their universities—the disease of asking questions."

ENGINEERS' INSPECTOR AT BUFFALO.

An important ordinance, published in our present issue, is before the City Council of Buffalo, N. Y., having been referred to the Committee on Ordinances. Mr. Benjamin P. Kane, chief engineer of Council No. 14, A. O. of S. E., at Buffalo, has done much to bring this licensing ordinance where it is, having spent much time and money and talk in advocating a good license law so as to elevate the profession of stationary engineers, and secure the lives of the public by having only competent men in charge of steam plants.

Mr. Kane is a first-class engineer himself, having had great experience as well as being well informed concerning the generation and use of steam. And we are glad to learn that he is in the race for the inspectorship that will have to be filled as soon as the ordinance referred to becomes law, which it is likely to do, we are informed, and that in the near future.

If the Mayor and City Council of Buffalo were to search the whole of the United States for an inspector of stationary engineers, when they are ready to appoint one, they would not find very many quite equal to Benjamin P. Kane, and very few (if any) better than him, for the position.

It is encouraging for the advocates of a sound licensing law to regulate the profession of steam engineers to see such an important city as Buffalo coming to the front, with such a good ordinance. And when it becomes law, and is properly administered, we shall not expect to hear of boiler explosions in Buffalo, N. Y.

THE FLY-WHEEL CATASTROPHY.

A defective governor was the cause of the "Amoskeag Accident," according to the *Boston Journal of Commerce*, from which we extract the following:

What caused the fly-wheel of the engine at the Amoskeag mills to burst? is a question that mill engineers will ask, but which may not be so readily settled, at least, whether the wheel was defective or not, as was claimed by Superintendent Marning in his examination by the coroner's jury. It is reported that the speed had been very irregular during the morning, mills Nos. 4 and 5 running very slowly, and mills Nos. 7 and 8 with increased speed, and in all probability the belts to mills Nos. 4 and 5 were slipping. This would account for the slackness of the speed there while the other mills were run so fast. The water power has been low of late, and the engine required to do a great amount of work, and for some time has averaged 1950-horse power at 61 revolutions per minute. When interviewed on the matter, Marcelius Gould, tho superintenden of carding, stated that a few minutes previous to the disaster he had noticed a slackness of speed in No. 5 mill and, as is customary in such cases, ordered the machinery shut down and went to the engine house to make inquiries. These mills, then shut down, and the varying and increased speed felt in the other mills caused them also to shut down at about the same time or soon after, thus throwing the whole load off the engine that a moment before was, if anything, overloaded. This would readily account for the fatal racing of the engines, but whether this was the direct act that led to the accident or not, the real blame must be attributed to the governor in falling to act properly and to control the speed. It may be that all the load was thrown off at the same instant, such an increase in speed as would immediately follow, should make that governor absolutely prevent a particle of steam to enter the cylinder of the engine. That the governor did not do so shows conclusively that it was either improperly designed and set, or not in a working condition.

This is not the first time a fly-wheel has burst

from a failure of the governor (the Lynn accident was such a case,) and it will probably not be the last, but the lessons such accidents teach, should not pass unheeded. It is such a curious fact that this is possible in an age when we expect experience to teach us so much, and with engineers taking so much pride in their achievements. It is possible to design and make a governor that will govern, and no governor should be upon any engine which does not have such a range as will not open the steam port at one part of its range, yet we know of engineers who repeatedly set valves so as to cut off, at least, one-sixteenth of the stroke when the governor is against the upper stops. This is wrong, for the slightest amount of steam admitted to an engine suddenly relieved of its load, and up to speed, will cause a dangerous racing in a few seconds, and it only needs a few seconds to pass the limit of safety. Every engineer should know that his governor can, if there is need, be in the position that the valve will be tripped before the lap of the valve is uncovered. It can be done, and not to do it is to invite disaster and put a premium on carelessness.

It is as important, also, that the governor should then be properly cared for and frequently tried. Working in the same position for so long a time, the regulator column is likely to wear shoulders. This is not likely to hold the governor down in a position much below its normal, but it is likely to prevent it reaching a height sufficient to shut off steam, as much as though its movement was porposely limited.

There is a possibility that there was a defect in the fly-wheel casting which reduced the factor of safety and caused it to give way sooner than it otherwise would; but even so, engineers cannot lose sight of the fact that the governor that was supposed to control the engine under all conditions failed to do so. Though flaws in the fly-wheel may have contributed, as the sudden release of the load did, to the accident, the failure of the governor did the mischief, however much that fact may seem to be covered.

ENGINEERS WANTED.

The sheriff of Cook county, in which Chicago is situated, has filed a petition in the Circuit Court asking for the following help: Two janitors, three janitresses, three watchmen, an elevator man, chief engineer for Court House, three assistant engineers, five firemen, one coal-passer, one pump man, an electrician and assistant, chief engineer for jail and Criminal Court Building, two assistant engineers for same place, and three firemen.

Those seeking a city position had better call upon or communicate with Sheriff Gilbert, Chicago.

ENGINEER BURKE DISCHARGED.

In the Circuit Court at Racine, Wis., Nov. 10, the District Attorney offered a nolle prosequi in the case of the State of Wisconsin agalnst Martin Burke, charged with criminal carelessness while engineer on a passenger-train on the Northwestern road that collided with a freight-train at Racine Junction last May, resulting in the death of three men. The District-Attorney said that in his opinion it would be difficult to secure the conviction of the defendant and he was discharged.

AN ENGINEER SHOT THROUGH WALLS.

A communication from Sunbridge, Ontario, Nov. 6, says: M. E. Tookey's planing mill was wrecked to-day by the explosion of a boiler. James Turnbull, the engineer, was driven through two partitions. Both his legs were broken and he was terrible scalded. William Cassidy, a carpenter, had a leg and an arm broken by being struck by falling machinery. Several others were scalded and otherwise injured, but not seriously. The boiler rose eighty feet in the air and landed 100 yards away, fortunately taking a direction in which there were no buildings.

The District of Columbia has decided to ask Congress for an appropriation of $50,000 to enable it to make a creditable exhibit at the World's Fair Exposition.

THE COLUMBIAN EXPOSITION.

Following are the rules of the Machinery Department, as scheduled by Chief Robinson, and as approved.

1.—A limited quantity of steam or water power will be furnished for the purpose of exhibiting machinery in operation, the quantity of each to be definitely settled at the time of allotment of space. Any excesses will be charged for at a fixed price. Demands for such excess must be settled at the time of allotment of space.

2.—By special arrangements the installation of heavy articles requiring foundation should begin while the building is under construction. The floor of machinery hall will support 250 pounds per square foot. The heaviest single piece received must not weigh more than 30,000 pounds, as facilities will not be provided for handling heavier weights.

3.—The steam pressure supplied will be 150 pounds to the square inch. Water pressure will be that due to a head of 225 feet, or a pressure of 98 pounds the square inch, and a head of 40 feet, or a pressure of 175 pounds to the square inch.

4.—Driving pulleys are limited to 36 inches in diameter.

5.—Exhibitors of steam and other machinery who desire to offer the exhibit for use by the Exposition Company should send their applications as soon as possible. Such exhibitors may select their own men to operate this machinery. Their wages will be fixed and paid by the Exposition Company.

6.—The Exposition Company will defray the necessary expenses of exhibitors, loaning them machines, tools, etc., for the use beyond that which they would have incurred as exhibitors simply, wear and tear excepted.

7.—No fire will be allowed in machinery hall, except by special permission. Not more than a day's supply oil, or other inflammable substances, will be permitted in machinery hall, but a suitable place for storage of these materials will be provided.

8.—Exhibitors not desiring to employ attendants or watchman, may leave their exhibits in the care of the department, which will assume the responsibility for their cleanliness.

QUEER TREATMENT OF R. R. ENGINEERS.

The Board of Adjustment of the Brotherhood of Locomotive Engineers has been in session at Omaha, Neb. for the past six weeks. It is composed of twenty-one of the most prominent engineers between Omaha and the Pacific Coast.

While this board was in session Nov. 10, a special telegram says: A squad of police swooped down on them, and arrested G. W. Hansen, A. E. Brees, and the Chairman, all of the Union Pacific system, for alleged participation in the hold-up of the Misouri Pacific express last week. They were unceremoniously hustled off to jail. The protestations of the prisoners were abruptly choked off. They told who they were, and asked the detectives to go with them and they would furnish the most convincing proof that they were just what they represented themselves to be. They wanted to send for other members of the committee, but the officers would not listen to it and hustled them away to jail. The prisoners were taken into the chief's office and closely catechised, and were finally ordered below, where they were searched and then locked up in separate cells. They stated that they were locomotive engineers, and asked to be allowed to explain, but were told to keep quiet.

But the situation assumed a different aspect, when a big delegation of indignant engineers appeared at the police station, and in language more forcible than polite, demanded to know by what authority or under whose instructions their comrades had been placed in custody. They said that not only could they vouch for the prisoners, but they could also get the indorsement of S. H. H. Clark, general manager of the Union Pacific system. The railroad men did not mince matters at all, and though the chief had them in his private office with the doors tightly closed he was given to understand that unless the men were at once released there would be trouble in the vicinity of the police station. The men were released.

After the men had been released orders were given to have their names erased from the register, and all the chief's subordinates were instructed to know nothing whatever about the case. They even forgot that there had been any such persons there, and were sure that no arrests had been made.

A GOOD LICENSING ORDINANCE.

Following is a copy of an ordinance to provide for the inspection of steam engines and boilers used in the City of Buffalo, N. Y., and to prohibit the use of unsafe ones; to prohibit any person who has not been duly licensed under such regulations as the Common Council may prescribe, from running any steam engine, stationary or otherwise, in the city, except the engineers of duly incorporated steam railroads, and engineers duly licensed by the authorities of the United States; to classify such engineers and to provide for the appointment by the Mayor, of such inspector, examiner and employes, as may be required to carry out such ordinance.

Sec. 1. There shall be appointed by the Mayor, after the passing of this ordinance, and thereafter at any time the office may become vacant, an examiner of stationary engineers, who shall have charge of the carrying out of this ordinance.

Said examiner shall be a citizen of the United States, and shall have not less than ten years' practical experience as a stationary engineer, and shall hold office until removed for cause. Two assistant examiners, who shall assist the examiner as shall be necessary to properly carry out the provisions of this ordinance. One assistant shall be a practical stationary engineer of not less than five years' experience, and the other assistant shall be a practical boiler maker. Said assistants shall be citizens of the United States, and shall hold office until removed for cause.

Sec. 2. It shall be the duty of the examiner to make such rules and regulations for the guidance and government of his assistants and inspectors, as shall be necessary to properly carry out into effect the provisions of this ordinance. He shall keep a record of the transactions of his office, and of any accidents that may occur on account of the explosion of any steam generator coming under the provisions of this ordinance, and shall render annually, before the first day of January, a report of the same to the Mayor.

It shall be his duty to give proper notice of the time and place where he shall examine all persons who shall appear before him for examination, as to their qualifications to operate and have charge of steam engines and boilers in this city, and he shall issue a license to applicants, as this ordinance provides.

Sec. 3. Every person within the city limits of the City of Buffalo, in charge of or operating any steam engine or steam boiler, except persons operating locomotive steam engines, or persons duly licensed by the United States authorities, shall appear in person before the examiner, within ninety days after the passing of this ordinance, for examination as to his qualifications as a stationary engineer, and if found qualified, shall be duly licensed as this ordinance provides.

Sec. 4. No person shall be granted a license unless he be a citizen of the United States, of good moral and temperate habits, and not under twenty-one years of age.

Sec. 5. Any person found in charge of, or operating any steam engine or steam boiler, in a state of intoxication, shall forfeit his license for any term not less than six months, and it shall be the duty of the examiner to cancel or revoke the license of any person licensed under the provisions of this ordinance, who shall be found incompetent or negligent in the performance of his duties as an engineer.

Sec. 6. Any owner, agent or user, of any steam engine or steam boiler, in operation, who neglects or refuses to employ a licensed engineer, to have charge of, or operate said steam engine or steam boiler, shall be doomed guilty of a misdemeanor, and liable to a fine not to exceed $250 for each offense, and stand committed until the fine is paid.

Sec. 7. The examiner shall have power to condemn or prohibit the use of any steam generator that is found to be dangerous to life or property, and it shall be his duty to stamp or mark such boilers or generators, and any person found offer

ing or having for sale, for the purpose of generating steam, such marked steam boiler or generator, shall be deemed guilty of a misdemeanor, and shall be liable to a fine of not more than five hundred dollars, for each offense, and stand committed until the fine is paid.

Sec. 8. Any person taking charge of, or operating any steam engine or steam boiler, within the city limits of the City of Buffalo, without having a proper license, shall be deemed guilty of a misdemeanor, and liable to a fine not to exceed fifty dollars, and stand committed until the fine is paid.

Sec. 9. All licenses must be renewed annually and no person shall have charge of, or operate more than one steam plant.

Sec. I0. A fee of three dollars shall be collected by the examiner upon issuing a license, and two dollars for each annual renewal, and all fees collected shall be paid by the examiner to the City Treasurer.

Sec. 11. All persons licensed under the provisions of this ordinance, shall be classified and graded according to the capacity or horse-power of a steam engine, steam boiler or steam plant, of which they shall be found competent to take charge, namely: Chief engineers, first-class engineers, second-class engineers, and special engineers.

Chief engineers to take charge of and operate any size steam plant. First-class engineers to take charge of any steam plant not exceeding 150 horse-power, and second-class engineers to take charge of and operate any size steam plant not exceeding 75 horse-power, and special engineers to take charge only of a certain steam engine or boiler to be stated in the license, such steam engine or boiler not to exceed ten horse-power; and such license shall not be issued for a longer term than one year.

Sec. 12. Steam boilers used in private dwellings only for heating, or cooking or heating, where the water returns automatically to the boiler without the aid of a pump-injector or inspirator are exempt from the provisions of this ordinance.

Sec. 13. Every owner, user or person having charge of any steam engine or boiler inside the city limits of the City of Buffalo, shall give the examiner or his inspector, free access to said steam engine or boiler, for the purpose of inspecting the same, and every steam boiler shall have a proper connection for the purpose of making a hydrostatic test.

Sec. 15. Engineers duly licensed under the provisions of this ordinance, shall have their licenses suitably framed, under glass, and hung up in a conspicuous place at or near their engine or boiler.

The ordinance was before the City Council Nov. 2, and was referred to the Committee on Ordinances.

NEW ENTERPRISES.

ILLINOIS.

Chicago.

Treat & Foltz have plans for a five-story building to be erected at Nos. 48 and 50 West Monroe street by Norman D. Fraser at a cost of $30,000. It will front north forty feet with a depth of 185 feet. The interior will be of mill construction. The building will be used for light manufacturing. Also a building on Whitlng near Wells street for the use of the fire insurance patrol. It will be of brick and stone and will cost $10,000.

Gregory Vigeant has planned a five-story store and office building, 25x99 feet, for George H. Fergus to be erected at No. 76 Dearborn avenue. It will be constructed of pressed brick and stone, and will cost $25,000.

Columbia Heights.

J. F. Keeney has located the Rice Manufacturing company at Columbia Heights. This company will employ fifty men, and contracts have been let for the construction of a brick factory 40x70 feet. Two hundred and eighty-six lots have been sold at an average price of $150.

MICHIGAN.

The city of Flint will buy out the present company operating water-works, or put in a new plant entirely.

St. Ingace will spend $6,000 putting in a new electric light plant.

Hancock will have an additional fire pump put in water-works. Capacity to be about 1,000,000 gallons daily.

Ionia will put in electric street cars.

NEW YORK STATE.

Buffalo.

J. N. Adam & Co., 387-389 Main St., are erecting a six-story iron, brick and stone building for dry-goods, to be finished this winter. Same will be furnished with electric light plant and two elevators.

The Builders' Exchange, cor. Court and Pearl streets, are putting up a seven-story building of iron, brick and stone. It will be ready for occupation in '92, and will be furnished with elevators, electric lights and all modern improvements.

PENNSYLVANIA.

Coatesville.

The Chester Valley, which includes Coatesville, Parksburg and several other iron making towns, is one of the chief centers of the plate-iron and steel trade. There is no steel plant there and all the steel that is rolled there is made elsewhere. A large open-hearth steel plant is to be built at once by the Lukens Iron and Steel Company, of Coatesville, the largest concern in the valley. The plant will contain six furnaces with all the necessary gas producers and appliances.

On the site now occupied by she mills of this company was built the first plate mill erected in this country. The present works consume about 1,000 tons of steel per week and contain the largest plate rolls in the country, rolling plate ten feet wide of any length.

Philadelphia.

City Councils of Philadelphia have appropriated $7,500 for an electric light plant to be placed in the Philadelphia County Prison. For further information address Howard Perkins, Supt., 10th and Reed Sts., Philadelphia.

For the Fairmount Ice Manufacturing Company plans have been prepared by Architect Goodwin for what, it is claimed, will be the largest ice manufacturing plant in the city. The new buildings are to be erected on the site of the company's present establishment,the northwest corner of Twenty-fourth and Green streets, on a lot 160x118 feet. The new buildings are to be of brick, with brown stone trimmings.

The main building is to be one story high, with a frontage of 81.10 feet on Twenty-fourth street, and a depth of 80.10 feet. The engine house, on Green street, is to be two stories high, 75x20 feet. The boiler house, on Pagoda street, in the rear, 40x55 feet, and the stables, 47x37 feet. The office is to occupy the corner.

The engine to be used will be of great strength, the fly wheel alone weighing 20 tons, and there are to be three boilers of 155 horse power each. The water for the ice is to come from artesian wells in the yard, and it will first pass through the boilers, so that the steam can be utilized to drive the engine. It is then to go through a series of processes intended to result in the production of 100 tons of ice a day.

The Hotel Vendig to be erected at the north west corner of Twelfth and Market Sts., will cost about about $50,000. It is to be a five-story building of buff brick trimmed with Portage red stone. Six stores and a bar-room will occupy the first floor, while the upper stories are to be devoted exclusively to the use of guests. It will be furnished with elevators, electric lights and all modern improvements.

The recommendations of the Building Committee of the Board of Managers of the Pennsylvania Hospital, in regard to the erection of the new administration buildings of the institution, are substantially as follows:

It is designed to place the administration building close to Spruce street, in the middle of the block between Eighth and Ninth streets, where the Nurses' Home now stands.

The building will be about 60x60 feet, three stories high, and will contain the business offices, the lodging rooms for the Steward, the Librarian and the Resident Physicians. It will also become the depository of the hospital library and of West's celebrated picture of "Christ Healing the Siek."

About 25 feet south of the administration building, connected by a covered way, will be the service rooms of the new hospital proper, as also the stairs and elevator. On each side of these sections will be the ward sections, 25 feet wide by 100 feet long, from north to south, and two stories high. There will be four large wards, to contain 26 beds each, making a capacity of 104 beds in all. A portion of the building will have a third story, in which there will be fitted up a number of rooms, baths, etc., for use in cases of emergency. This new group of buildings will be warmed and ventilated by means of steam generated in the central boiler house, where, in the near future, will also be placed a complete plant for electric lighting, whereby the buildings and grounds will be fully illuminated.

The external architecture of the new buildings will harmonize with that of the present hospital, built one hundred years age, or of the Colonial period. The designs are well advanced, but not sufficiently mature for publication.

The building now occupied by the nurses will be removed to give place to the new administration building so soon as a more commodious Home within the grounds can be prepared for them. The plans for this building indicate a structure about 37 x100 feet in dimensions, three stories high, containing 42 rooms for as many nurses, with suitable bathrooms and every convenience to make it homelike.

This will be of necessity the first to be built in order to clear the site for the more extensive operation. It was also stated last evening at the hospital that the old buildings will be sufficiently remodeled to accommodate in all about 300 beds.

The McCahan Sugar Refinery Co. is now being organized. The entire plant is expected to be in operation by January 1, 1893.

The buildings of the company are expected to cost in the neighborhood of $2,000,000. The plans are being prepared and the contract will be awarded about the first of the year. Three large buildings will be erected near the old molasses house, one to be us as a filter house, another as the sugar house, and the third as the boiler house. The entire refinery will have a capacity of from 2,000 to 3,000 barrels per day.

A six-story building is about to be erected by Joshua R. Jones at the corner of Cherry and Carmen streets from plans by Architect Will H. Decker. The building is to be pressed brick with trimmings of marble. For further particulars address Joshua R. Jones, cor. Levant and Spruce Sts., Philadelphia.

OHIO

Cleveland.

Following is a hit of new buildings and enterprises, that has come to my notice.

The Vanwagner Shelf Hardware Co., of N. J. will manufacture shelf hardware. The works are on a corner lot and Hamilton street, the main building is 150 by 300 feet, with an L 100×150 feet, two stories high, and including several other small buildings.

The Cleveland Hardware Co. manufacturers of carriage hardware had their works recently burned down, and are now rebuilding them on Lake street, near Kirtland, C. Adams, Superintendent.

The Stone estate are building a large block on the corner of Water and Superior streets, to be 50 by 100 deep, eight stories high, and to be used for offices. The building will have to passenger elevators, electric light, and heat by steam, S. A. Raymond, agent.

Fulton Market was thrown open to the people on the 15th. This building is 60×100 feet, four stories high, and is used as a wholesale and retail market fish, game and meats. It has two five-ton freezing engines, manufactured by the the Buffalo refrigerating Co. They intend adding another boiler to their plant.

The Kings brothers have built a large block on Uclid avenue, not finished yet, 80×60 feet, 6 stories high, which will be occupied by Vincent Barston & Co., furniture dealers. It will have two passenger elevators and one freight. It will be heated by steam.

CORRESPONDENCE.

A Vote of Thanks.

Editor, American Engineer:

Laclede Council No. 1, of Mo., desires to return a vote of thanks through the American Engineer to the Buckeye Engine Co., of Salem, Ohio, for the donation of a large picture of their Tangye Engine, neatly framed to hang up in the council chamber.

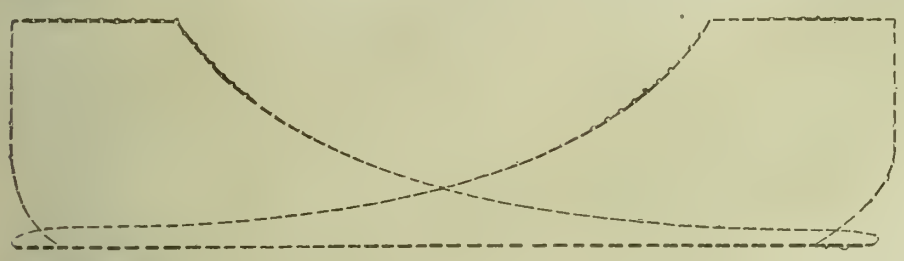
By order of the council.

J. N. Wood, Cor. Eng.

A Card.

Editor, American Engineer:

Inclosed you will find card taken with an arc indicator of a Corliss.



Scale of Spring.....60.
Revolutions.....60.
Stroke.....36 in.
Cylinder.....16 in.
Steam Pressure.....80 lbs.

Please copy card and publish in next issue. I should be glad if some one will figure out its details.

G. N.

Well Informed Engineers.

Editor, American Engineer:

That education is one of the chief corner stones of the A. O. of S. E. few will deny. The article in the last issue of the American Engineer on Stationary Engineers very much impresses me, calling to mind many facts that are only too true. I call to mind two cases that I know of, one where a man was receiving $15 per week was discharged to make room for a $12 man; the bill for repairs under the first man was $12 for one year, the bill for repairs under the second for one year was $85; and after the man had given up the job, it cost a great deal more to put the machinery in proper working order.

The second case is one where a man stated to his employer that he would like to have an indicator very much; ten days later he had one at his employer's expense; one employer appreciated the efforts of his engineer to obtain knowledge, the other did not.

Then, again, many engineers wonder why their brother engineers know so much, and are so well acquainted with the latest improved machinery and methods, and have not followed the business for 25 or 30 years either. The writer knows of a young man who has only had a license for 3 years, and I do not think there is a manufacture of engines, pumps, or heaters, or any kind of machinery connected with the engine room that he has not their catalogue and price list. He can describe the valve motion of nearly every make of engine; can tell you the advantage that one make of pumps has over another; can explain the principle of the different makes of heaters, and so on. And all that this valuable information costs him is the time it takes to study them and the postage, manufacturers of machinery are only too glad to send their catalogues, with much other valuable information, if one will only write for same. A well posted man never wants for a job; but the man that knows it all, and cannot learn anything, it is time to put the screws in his coffin.

So I say that every council should have a library with good books, also the catalogue of various manufacture of machinery, so that when an engine wants anything he knows where to go and find it.

J. W.

The Education of Steam Engineers.

Editor, American Engineer:

The educational department of the different orders of steam engineers throughout the United States are slowly but surely advancing the ability of their members; and in doing so, they also advance the salary of the valuable engineer.

The employer of to-day is vastly different to the one of twenty-five years ago. At that time, if a factory or mill was kept grinding away, the power furnished by the old rocker valve, or by the common slide valve engine, and the economy of steam, were not in question. But the employer of to-day is not satisfied with the old slide valve, but looks further. He will not depend on his own limited knowledge of the steam engine, but visit, first one, than another steam plants, get in conversation with the engineer in charge of the New Corliss, or other well-known economizing engine, and he soon learns that the engineer in charge is able and capable of talking with marked inteligence on the amount on power saved by the use of the patent improved appliances so well known to the reading engineer.

The owner of the old plant will soon be convinced that he had better pay more salary to a man who is able to define the power and use of steam, and save much on the wear and tear of machinery, the over crowding of boilers, and immense coal bills each month, and he will do it every time.

Now a word about this engineer: you will find, if one should observe closely, that at home of an evening, after supper, he will spread before him the leading mechanical papers and enlighten himself on what occurs each day, on all the new improvements, etc., and regularly when the meeting night of the engineers' council or association arrives, he is (if a member) one of the first to go before the black board and explain to his brother engineers, this or that point about machinery that is not clear to them, not forgetting the fact that the more he instructs his hearers he also perfects himself.

Eye.

NEED OF DATA ON WEAR OF RUBBER.

Without entering the contest between rival claimants to the honor of discovering the vulcanization of rubber, it is interesting to record the story of Nathaniel M. Hayward's first struggles after a solution of this problem. In default of scientific knowledge, he was forced to trust to luck. His fisst compound was a curious mixture of ingredients, which by merest chance contained a piece of roll sulphur. The product surpassed his highest anticipations. It was firm, elastic, and no longer became sticky when exposed to the heat of the sun. But, as it happened, he had forgotten a portion of his experimental recipe; the sulphur was omitted, and the second batch was a failure. A dream, however, prompted his treacherous memory, and restored the precious secret. Such is the romance, and, whether true or not, it illustrates the character of the large part of the work which has been done during the past fifty years in the development of the rubber industry.

The experimenters have not been men of science, and they have not followed scientific methods. They have, however, been men of sound common sense, possessed of a fair amount of general information, which they have known how to apply advantageously, and they have accomplished really wonderful things. Yet the progress in rubber manufacture has been due in large measure to a series of clever guesses. Even to-day there is but a single rubber manufacturer in America who employs a chemist. While there is a certain uniformity in the processes of manufacture, there is also a most astonishing variation in the details of treatment, and in the recipes in vogue in the different factories for the production of what purport to be similar grades of rubber goods. These special processes are in the majority of cases guarded with extreme jealousy as "trade secrets." The possession of "secrets" in most branches of manufacture is a specious pretense, a piece of ludicrous folly, but the rubber business has not yet emerged from its middle ages of cryptographic mysteries into its period of scientific development. There is not in existance a treatise on rubber manufacture which gives formulæ for compounds, and descriptions of processes, by which goods can be manufactured equal to those now on the market, and the writing of such a book at present would be an impossibility. Even the best superintendents of rubber factories merely know those processes with which they have chanced to come in contact. They still remain in ignorance of a mass of information which can be obtained only by actual experience in all the leading factories in the country. The chemistry of rubber has been very imperfectly studied, and its physical properties have been made the subject of thorough research by only one American physicist, and even he has done scarcely more than indicate a number of wonderful characteristic, each of which is deserving of special investigation.

On the practical side, the consumer of rubber is continually the victim of the tradesman's desire to sell. If he finds an article that serves his purpose well he naturally persists in the use of that brand, but he can not be sure that it is the best that could be found. The fact is, a very little difference in the curing temperature, or in the amounts of the various adulterants, effects the value of the rubber for specific uses, rendering it good for some, and bad for others. In this case of rubber hose connections for steam heating apparatus, for instance, the purer the rubber the greater is its tendency to become spongy. Sometimes the "lining" will sponge up and almost close the pipe before the "friction" and "cover" are affected. The introduction of certain adulterants will entirely remove this trouble, and give the hose a long life, while other adulterants will cause the rubber, under the influence of the steam, to lose its elasticity, grow hard and crack. The usual tests of a sample will not show how the hose will behave under long continued use. Nothing short of a comparative study of the effects of service upon rubbers of different manufacture can determine such a question.

So of air brake hose; it is the one item of brake equipment on which intelligent judgment cannot be used. It would be worth a great deal of money to buyers of air brake hose to know how the *best* could be selected from among the samples offered; but the makers themselves could not furnish tests that would be exclusive. So all that one can do is to buy of the maker who gives him good satisfaction and has a valuable reputation. It would of course be well to know the compounds and the treatment employed in each case, and in time, when rubber manufacture has become a science in the sense that the metallurgy of iron and steel is a science, this *will* be known, to the benefit of both consumers and manufacturers, but at present *data* as to the wear of rubber in its various applications must of necessity refer simply to the manufactures' brands, although the virtues of some adulterants can be ascertained definitely.

Considering the innumerable uses of rubber in the mechanic arts it would certainly seem a wise step for some of our engineering societies to appoint committees for the purpose of collecting *data* regarding the wear, and, as far as possible, the causes and conditions of failure, as well as to seek by experiments reliable rules for testing the value of some of the rubber articles of most general use, such as belting, hose, packing and the like. A contribution of immense importance might thus be made to one of the greatest of our growing industries.—*R. R. Gazette.*

WHO WILL BE THE WINNERS?

The American Engineer Publishing Co., with the view of bringing up the circulation of the paper to fully 20,000 copies each issue, offer a premium of $40 to the one who will send in the greatest number of new subscriptions, $20 to the one who will send the second greatest number, and $10 to the one who sends the third greatest number of new subcriptions, by January 1, 1892.

The president of Ecuador has ordered that a complete display of Women's work shall be prepared for the Fair. This is to include a collection of gold and silver braid work, woven straw, and other novelties. Two or three women may be sent to Chicago to take charge of the display.

THE WOMEN'S DEPARTMENT.

Daughters of Fulton.I

Editress, American Engineer:

I heartily thank you and the American Engineer Publishing Co., for opening a department for the women, which will be of great value to the daughters of Fulton, and others too.

Now we may be able to know what our auxiliaries are doing, and see what work and plans have been laid out for the approaching winter.

It affords me much pleasure to state that Elmira Auxiliary is progressing splendidly. We expect to initiate three ladies and three gentlemen at our next meeting.

I sincerely hope that the sisters of all our auxiliaries will make good use of this department, and avail themselves of the opportunity to let the others know what they are doing; and also to show that we highly appreciate the marked kindness shown to us in placing two pages of each issue of the American Engineer at our disposal.

Hoping to hear from other auxiliaries, and that soon, through your columns, also from others who may take interest in the Daughters of Fulton.

I remain yours in

Friendship, Protection and Relief,

(Miss) May E. Deas, S. Sec.

8 Harrison st., Bridgeport, Conn.

P. S. I almost forgot to state that we are soon to have a degree, specially for the gentlemen, which I am quite sure they will enjoy.

I would also ask you to please publish the enclosed letter from Bro. Eben B. Hill, which speaks volumes in favor of such an organization as the Daughters of Fulton, and I have obtained his permission to publish it.

Beneficial Influence of Women.

Mrs. Elmira E. Deas, Supreme Matron D. of F.

Dear Madam:—Your kind letter was duly received, and the cards, containing the principles of the Daughters of Fulton, were distributed as desired.

I will do all in my power to help along the good work you have started, and I was wondering why it was not thought of before.

It calls to mind, the remembrance of my first joining a secret society. I had not been a member long, when our presiding officer was taken sick and died, it was a sad case, I recollect it well, although it was over twenty years ago; our brother's people were very much opposed to secret orders, and did all they could to make it unpleasant for his widow in her distress. Some years after, I became well acquainted with her, and speaking of her affliction and trouble, and of the kindness of the brothers, who did all they could to help her, she said: If some of them had only brought their wives with them, when they called, what a blessing their sympathy and womanly love would have been—what a relief and comfort that would have afforded.

I have often thought of this, after hearing her speak about it, and this is one of the reasons I wish the Daughters of Fulton God speed. Nor do I think it will stop here, but think of the good it will do our young engineers. Nothing is so refining as good society and sociability, when its influence is extended to young men, it may be the means of keeping them from leading lives of dissipation.

I was brought up in the east, came to St. Louis when I was seventeen years of age, living in this vicinity ever since, although all my relatives still live in the east. I have a cousin clerking in the cartridge factory in your city, who resides in Stradford. My home was a happy one, my parents, brothers and sisters, did all in their power to make home attractive, for that reason there was no desire to spend my evenings at clubs, bar-rooms, or other places too numerous to mention, and when I left it, and came out here, where I boarded in a common boarding place, I felt the loss of the home influence. I hardly knew what it was that made me feel so lonely, I can not explain my feelings, but something was missing, and I could not explain what it was.

I know there are lots of young men, who go astray of such feelings and homesickness, and are invited to saloons, going there reluctantly at first, but recklessly at last.

Just at the outbreak of the war I was at St. Joseph, Mo., running on a boat from there to Omaha. When I was in either place on Sundays I used to go to church, but during that season, no one at church ever came up to speak to me, or to give me an invitation to come again.

In early fall, coming down the river, we snagged, taking one of our wheels overboard, so we had to lie at St. Joseph for over a month for repairs. As they stopped living aboard, we had to board in town. The captain sent us to a second-class hotel. One morning I overslept and was not at breakfast while my shipmates were eating..

When I went in to eat I found the captain's wife, daughter and little son, who invited me to eat with them. I did so and it proved to be the most pleasant time of my life, and whenever we put in at port at St. Joseph afterwards, she invited me to spend my evenings at her home. Before this time my lonely evenings were spent on the boat, but the change made everything so pleasant, that when leaving at the close of navigation in the fall, she told me the interest she took in me, was caused by the remark I made of my mother, the morning I ate breakfast with her. She said a great many excused themselves for not becoming acquainted, and being more sociable, by saying that they had never received an introduction.

But I must close, promising to do all I can to promote the interest of the Daughters of Fulton in Misouri.

Sincerely yours,

Eben B. Hill.

If I were a Girl.

I would take care of my health, by living outdoors as much as possible, and taking long walks in the sunshine. English girls understand how necessary this is for the complexion and cheerful spirits. Wear simple clothing, that you may climb mountains and breathe freely.

I would secure the best education. Go to college, by all means, if it is possible. A woman, in these days, if she would be attractive as well as useful, must be intelligent. Educated men need educated wives. Children need educated mothers. Women themselves need a broad education, lest their thoughts become centered in clothes or in the small round of society gossip which belittles. Read good books and thereby become intelligent.

I would cultivate cheerfulness. Discontent soon shows itself in the face. If you have some disappointments, so do others. If you are cramped for money be thankful that your lot is no worse than it is. Learn to make the best of things. An unhappy woman is a perpetual cloud in a home. A fretful girl has few friends, and the number lessens year by year.

I would say kind things of others, especially of girls. A girl who makes unkind remarks about other girls had better be avoided by young men. She will not make an agreeable companion for life.

I would learn how to be self-supporting. Especially in this country, where fortunes change, it is wise for a woman to be able to care for herself. Helpless women are not a comfort to others, and usually are not to themselves.

I would try to be polite everywhere. True courtesy is more winsome than a pretty face or fine dress. Loud talk or loud dress does not betoken the lady. Be appreciative and sympathetic, and you have two keys which will unlock almost all hearts.

I would learn self-control. To know when to speak and when to be silent, to have hateful things said about you and be able to answer pleasantly, to have people confide in you and be wise enough to keep it locked in your own heart, to be in poverty and not be soured by it, to meet temptation and be strong before it, to be strong enough to perform any labor or duty that needs to be done—all this shows a noble mastery over self.

I would be punctual. Being late at meals, late at church, or late in meeting engagements makes unnecessary friction in families. If we are willing to lose valuable time, we have no right to make others lose it.

I would not be careless about the affections. Girls too often think that young men are not easily hurt in love matters, or if they are, they soon recover. As a rule, probably, men love as deeply as women, and to play with hearts is a sin.

I have known girls engaged to two young men at the same time, thoughtless as to the effect upon those whom they could not marry. It is a pitiful thing to spoil a life, and it is not infrequently done. The golden rule of doing unto others as we would that they should do unto us is especially applicable here—Sarah K. Bolton, in *Hearth and Hall.*

NOVEMBER.

The melon-colic days so queer,
Are gone, and we are glad:
The *gros-grain*, gray-green, green-corn ear
Has gone to shucks—too bad!
The yellow cow-slip's on its ear,
The chestnut burs have bursted;
The maple leaf is brown and sere,
The *zephyrs* are all *worsted*;
The turkey gobler's doomed to die—
To lie in *grease* with *sages*:
The summer freckle, three, four-ply,
Is in its lowest stages;
The sea side hotel at the beach
Is just now out of friskers
Who let old Neptune's salt air screech
All through their hair and whiskers.
Our lives assume the sombre hue
Of seal-brown autumn leaves,
While wondering what the weather 'll do
After the Autumn leaves.

Putting Younger Women to the Blush.

Mr. Gladstone puts younger women to the blush by their undaunted energy and vigor of mind says an exchange. After a summer of great anxiety and severe domestic affliction, to say nothing of active work in the various fields of labor in which she is so devoted and so indefatigable, Mrs. Gladstone is employing the "recess" by writing a series of articles for a woman's paper upon the management of children, in which she gives interesting reminenscences of her own experience with little ones. Considering that her eldest child has just died at the age of 51 years, there is no need to say that this wonderful woman's brain and memory are no less clear than those of her husband. The secret of Mrs. Gladstones vitality of mind and body lies undoubtedly in the fact that she has always exercised both. She has led a busy life, interested herself actively in politics, in philanthropic and church matters, has been a devoted mother and attentive wife, and finds time now to look after the grandchildren'swelfare and amusement, and, withal, apparently knows nothing of nerves.

Miss Collet's Investigations.

In Mr. Charles Booth's "Life and Labor in East London," one of the most interesting chapters to women is that to which the signature of Miss Clara Collet is attached, says the *Queen.* "Women's Work," it is entitled; but there is no mention in it of the ordinary feminine arts, such as cooking, dress-making, or nursing. In place of these Miss Collet tells about match-boxmaking, furriery,stay and umbrella making, and she initiates us into the curious history of an East-end shirt, following it as it passes from hand to hand in a descending scale of social misfortune.

A Londoner by birth, Miss Collet, belongs to the intellectual world by inheritance. Her father is one of the few survivors of the little band of Chartists (though his opinions in later life have undergone a complete change), and in 1848 he and Mr. Linton, the celebrated engraver, were delegated by the Chartists to congratulate France on the attainment of a republic, and accompanied Mazzini on this mission.

Miss Clara Collet was educated at the North London Collegiate School. She matriculated, and would have proceeded to take her degree at London University, but degrees at that time were not open to women. She had not long, however, to wait for the coveted degree, and in 1880 she was one of the first four women who became B. A.'s of London. Miss Collet proceeded to her M. A. degree in 1886. She also won the Joseph Hume Political Economy Scholarship.

Her education was thus completed. Now came the crucial moment in her career. The obvious—the commonplace—course was to teach others what she had first learned herself. But this was not Miss Miss Collet's idea. She felt that, so far as her special subject—political economy—was concerned, she was only on the threshold of knowledge. She had learned all that the lecturers and the textbooks could teach; but there were great fields of knowledge which she longed to investigate for herself, and upon which at that time scarcely any light had been thrown. There was, for instance, the whole history of women's work for the last century, dating, it may be said, from the introduction of machinery in 1780, when women began to work in factories, and it became possible to know what they did and what they earned. The subject was ripe for such inquiries, and Miss Collet was eminently fitted to undertake them. Political economy, however, has the misfortune, like other abstract sciences, of being unremunerative, and Miss Collet was naturally obliged to consider the question of ways and means. Miss Buss meantime had invited her to lecture on her special subject at the North London School, and knowing her wishes at the time, had agreed with characteristic magnanimity to cancel the engagement should she be enabled later to obtain the kind of work she preferred. When the opportunity came—as opportunities do come to people who know what they want—Miss Buss was as good as her word.

Mr. Booth, before he got together his little band of helpers for his book, had advertised for duly qualified investigators. Miss Collet saw the advertisement and at once applied to it. But the answer came "not suitable for a lady." She learnt afterwards that she was the only woman who had replied. So she bided her time. Presently Mr. Booth discovered that he must have a lady in order to learn all the conditions under which women work. He asked Prof. Croom Robertson whether he could recommend a woman. Now, Prof. Croom Robertson had been Miss Collet's teachers at University College and knew that this was precisely the kind of work she had told him she should like to undertake, and thus the matter was arranged.

Her work for the first volume of "Life and Labor" was entirely relegated to the East End, a circumstance which did not render it the more easy for an inexperienced woman. Viewing the task only from its external side, it demanded very considerable physical strength, for the East End is a vast realm, the distances are great, and Mr. Booth's "special lady commissioner" would find no pleasant club or restaurant to break the long day's march from one factory or workshop to another. She met this, difficulty, however, by taking a lodging in the East End for a time. But the real problem to most people would be how to obtain the information. To call upon an employer for the purpose of discovering what he pays his workpeople seems at first sight a delicate if not an impossible mission. Miss Collet ascribes her success in it chiefly to the fact that she approached the difficult question of the relation between employers and employed with an absolutely unbiased judgment. She sympathizes with the troubles of employers; she does not always hold that trade unions are in the right; in any case her own views play but a small part in the affair. What she really and keenly desires is knowledge—knowledge for its own sake, and as its own reward. Employers have recognized this impartial scientific spirit in her, and have in the majority of cases met her requests with a courtesy which she gracefully acknowledges. They have allowed her free access to their books, and even have gone out of their way to facilitate her investigations; as, for example, when one employer placed a room entirely at her disposal as long as she required it.

Miss Collet's paper in the *Economic Journal*, which has attracted a good deal of attention, was the result of a visit to Leeds. She selected Leeds because the clothing trade, which forms the staple industry of the East End of London, is carried on there, and because the history of the trade can be traced back with tolerable ease. Her observations point to the fact that workers, whether they are at home or in factories, are much better off in Leeds than in London. She hopes before long to visit some other towns in Yorkshire, such as Dewsbury, Batley and Huddersfield.

Miss Collet is at present assisting Mr. Booth in an inquiry which he is prosecuting at two London Workhouses, in order to learn more about the conditions of pauperism, and the materials will probably be utilized in a paper to be read by him before the Statistical Society.

Absorbed though she is with the modern enthusiasm for the collection of "human documents," Miss Collet retains a lively interest in educational questions, though even here, indeed, it is chiefly educational questions, where they mingle with economics, that attract her. She is on the committees of the Assistant Mistresses' Association and the University Association of Women Teachers, and shares, with the majority of educational authorities, in the desire that the salaries of high school teachers should be raised. As a delegate of the University Association she appeared lately before a select committee of the House of Commons to give evidence against the proposed compulsory registration of teachers.

The Jealous Bear.

Grizzly Bear (to his wife)—I saw you hugging a strange man.

Mrs. Bear—You wrong me, Griz. That wasn't a man. It's a nice fat dude I caught for our Thanksgiving dinner.—*Jury.*

She Got Her Weight in Gold.

It was in the fall of 1855 at the wedding of the daughter of Contractor Pollock, head of the firm of Pollock & Cummings, the John D. Crimmius of that day. He lived in West Eighteenth street, between Eighth and Ninth avenues, next door to the old Eighteenth street school, long since torn down. She was a charming, rosy-cheeked girl, with a small but dainty figure. Directly after the marriage ceremony, while the wedding guests were still gathered in the parlor, Contractor Pollock weighed his daughter with gold pieces on old-fashioned Dutch scales, a tremendous affair such as they use for weighing cheese in Holland, and he piled gold pieces into the other scale until the little woman swung in the air. She tipped the scales at ninety-six pounds and it took, as I recollect, something between $17,000 and $18,000 in gold to set her swinging.

This created the biggest kind of a sensation in the town. I recall that the *Sun* had a most entertaining account of it. For months afterward crowds used to go to the old school to get a glimpse of the recipient of this generous dowry. The lower windows of the school looked right into the back parlors of the Pollock mansion and gave an excellent view of the little woman as she sat there sewing or playing the piano. She seemed to be amused by the popular interest that her father's whim had excited. The old gentleman was a Jim Dandy anyhow, and that $18,000 could easily be spared, because he was literally loaded with ducats. —*New York Sun.*

Took a Lion By The Tail.

When P.T.Barnum's winter quarters were burned two years ago one of the lions escaped and entered the barn of Mrs. Gilligan, a widow living on Pequonnock street, Bridgeport, Conn. Mrs. Gilligan bravely entered the barn, grabbed the king of beasts by the tail and belabored him with pitchfork handle to drive it out. Her pluck and courage were noted in the newspapers at the time, and she received many offers of marriage from men in the Far West who needed brave wives.

Mrs. Gilligan has again distinguished herself. She is a great poultry fancier, and her hennery is a standing temptation to the lawless tramps and toughs who make the neighborhood their headquarters. Yesterday morning she heard her chickens making an unusual noise, and, hastily dressing, she got to the coop just in time to see two men carrying off thirteen of her fowls. She followed them to their camp in the woods, and, jumping into the midst of the gang, she grabbed the chickens from the hands of the thieves and gave them a piece of her mind. Then she sent for the police and made complaint against the men. The next morning they were sent up for theft, and Mrs. Gilligan was complimented by the court.

How a Woman Acts in a Hotel.

A woman in a hotel is worth seeing, says a contemporary. She rings the bell three times to a man's once. She apologizes so profusely to the bellboy that he comes down stairs with not an idea of what he is to do. She writes about eight letters a day, and each envelope seems to contain at least three sheets of the hotel's paper. She sends the missives down one by one to be posted and "Ask the office, please, to put a stamp on for me," she says each time. She never makes out a wash list, but she "knows" just what she had, and one pair hasn't been returned. She refuses indignantly to confide more to "the office" when he inquires, but she is sure just how many were in, and "these have blue ribbons." She puts all sorts of things in the safe, but she is perfectly sure she put several things there that she didn't put there, and, of course, this makes it awkward for "the office," because he can't prove anything and she always "knows." She is always thunderstruck at the amounts paid for her bills, and she "knows" there is a mistake, says the Kansas City *Star*. The bills have to be produced, and even then she does not remember receiving the goods at all or buying them or anything. If she remembers afterward she comes down and explains to "the office" and apologizes, which makes him feel better. Sometimes she gets conscience smitten about ringing the bell so much, and then she runs out, rings up the elevator and gives the elevator boy orders. Yet people wonder at so many elevator disasters. An elevator boy's life has its ups and downs anyhow, but when the women come to giving him messages he loses his grip altogether and the elevator may take advantage of him.

The woman in a hotel expects the chamber maid to "see to" this, that, and the other thing, sewing on a button, taking a stitch, hanging up her dresses, and helping her to put them on. The chambermaid is only a poor human being who has a lot of work to do and the housekeeper to keep an eye on her. But what of that? The lady asks her just the same: "Iron these out for me, Mary, there's a good girl," or to "face up my dress, there's a dear," or to "put me in a few extra towels, do," or "get me a cake of soap—I'm leaving this afternoon." She tacks photographs up on the wall—that she will do—and she cries right in the office before every one when she is charged extra for damage to walls. Then cards and callers! O, heaven, give "the office" patience.

"I expect a gentleman to call about 9,' she remarks; "please say I am out. If any one else comes send them right up."

The gentleman is late and gets sent up. Heaven help "the office."

When a card awaits her she takes "the office" right into her confidence.

"Oh, dear, I'm so sorry!" she exclaims. "When did they call? Oh, yes, the time is on the card. If you had only told them to wait. I know I didn't leave instructions, but then, you see, I had no idea they would call, I didn't even know they were in town. Was the baby along, too? Oh, dear, I've never seen the baby. It was born last summer, and ——"

"The office" is perhaps not a married man, or perhaps he is, and in either case this is harrowing with a whole line of impatient men waiting for rooms. You understand now, don't you, why so few hotels have "the office" where the women can get at it?

AMERICAN SAILORS WANTED.

While Cougress has been so generous in legislatiug the new navy into existence, the personnel—both officers and men—has been almost entirely neglected. The majority of the officers are struggling maufully to keep abreast of the times. The requirements of naval science are now so great, and its developments so rapid, that they must apply themselves diligently during every sparc moment. The student age is long past for most of them, but iu spite of their years, the *esprit de corps* is such that they will not be found wanting when the hour of trial comes.

With the men it will be different, unless some change of policy occurs. Our crews are still largely composed of the dregs of all nations. The necessities of the service prevent any but a physical standard for enlistments; and nationality, intelligence, age, and moral character are not considered. Congress should realize that new vessels and new guns are incompetent to defend the national honor, unless they are efficiently manned. The ability of our officers cannot bring success in the next naval war, unless there is more trained intelligence among their subordinates.

In former wars we looked to the merchant marine and fishing fleet for our needed volunteeers, and they were an efficient reliance. But with the modern war ship the fisherman and the merchant seaman would not be any more valuable as a recruit than a landsman of greater intelligence, who could be more quickly trained as a gunner or torpedoist.

There is a consensus of opinion among naval officers regarding our unfortunate position; but they seem to differ widely as to the manner of improving it. Logical reasoning, and the experience of foreign navies, should convince us that there is but one solution. We must take intelligence in the formative period and train it to meet our necessities. We must have an efficient apprentice system.—From "The United States Naval Appreutice System," by Lieutenant A. B. Wyckoff, U. S. N., in November *Scribner*.

THE INNATE PUGNACITY OF MAN.

We are told in Scripture that if a man invites us to go a mile with him we are to go with him twain. Why? Not for fear of him, certainly; but perhaps because that is the wisest way in the long run. If we run against a post we don't beat it, however much it may have hurt us; but if a man runs up against us it makes us angry. The principle of resistance comes forcibly into our minds. The impact of man against post is merely a case of matter opposed to matter; but when it is man agaiust man the opposition is of spirit to spirit. Children will kick the post that they have run against. Savages find matter for blows in incidents which civilized people pass easily over. Refined people of good sense and good manners dodge with a bow and smile possibilities of difference in which their neighbors of a less perfect philosophy find occasion for squabbling. The tendency of progress is all in the direction of peace. Perhaps, after all, that remorse that follows unimproved chances of self-assertion is merely one of the throes of a savage instinct that dies hard.--From "The Point of View," in November *Scribner*.

Paraguay has decided to participate in the Exposition. Barbadoes, French Guiana, Ceylon and Corea have also joined the list.

POWER IN SMALL PORTIONS.

One of the modern ideas in the economical use of steam power is the use of a number of small engines located at various points in a large shop, instead of a single engine of sufficient power to drive all the machinery. Professor Coleman Sellers asserts that with the best shafting that can be made hardly one-half of the power generated by the engine reaches the machines when distributed by means of long shafts. So great is the friction that a shaft two miles long could not be turned by any amount of power applied at one end, as the shaft would be twisted off before it would turn.

In the new shops of the Pennsylvania Railroad at Altoona and Wall Station, this idea of subdividing power has been admirably carried out. In the Altoona shops there are seventeen small engines, ranging from five to eighty horse-power, and there are five engines in the Wall Station shops.

The same idea has also been carried out at the Newport News shipyards.

Another application of the same principle is shown in the use of independent engines for driving heavy pieces of machinery, many large machines being now constructed with engines attached.—*Philadelphia Record.*

I. M. Weston, President of the Michigan World's Fair board, writes to Chief Buchanan asking for a large space in the Forestry Building. He says Professor Beal, of the Michigan State Agricultural College, will make an exhibit in the Forestry Building of lathes, shingles, paper pulp, and lumbermen's tools. In addition to Professor Beal's exhibit, Mr. Weston says he will make an exhibit of the methods of lumbering—logging, logging railway trains, trucks, sleighs, pictures, etc.—and will show two sections of logs to be cut this winter. He says he has issued circulars to the lumbermen of the State to save such sections. It is his intention to make the features of the Michigan exhibit forestry, fruit, fish, and minerals. A committee of fifteen lumbermen has been appointed, all of them millionaires and all of them taking great interest in the work. Professor Beal will spend $50,000 in collecting specimens of the seventy varieties of trees in Michigan and the several hundred varieties of what the professor calls shrubs—that is, trees under six inches in diameter. The specimens of the standard trees which he will collect will be eight feet long. Professor Beal had charge of the Philadelphia lumber exhibit, which was burned. He is the best authority on trees and grasses in Michigan and perhaps in the country, his work on grasses being a recognized standard authority.

BUSINESS NEWS.

The Lidgerwood Manufacturing Company, of New York have secured the services of the widely known house of Fraser & Chalmers to represent them in Utah, Montana and Idaho. Parties located in that section of the country, desiring to purchase machinery for all sorts of hoisting purposes, will find it advantageous to deal with Messrs, Fraser & Chalmers. Their reputation in the business world is indeed an enviable one, and the improved Lidgerwood standard hoisting engines which they will handle, are by long odds the most perfectly constructed machines, for the service intended, in the market to-day.

RESPONSIBLE POSITION WANTED.

Mechanical Engineer, competent to design, construct, estimate cost, supervise erection, etc., of general machinery and wrought iron work, with practical and theoretical experience, desires a responsible position in any part of the country. Ad. M. E., care of the American Engineer, Pontiac Building, Chicago.

CONTRACTS OPEN.

Water-Works Franchise.—The city of Cape Girardeau, Mo., desires to let a franchise to a private company to build and operate Water-Works. Plans and specifications are now on file with the undersigned, and with Johnson & Flad. Consulting Engineers, Laclede Building, St. Louis.

Sealed proposals will be received up to 6 o'clock p. m. Monday, the 7th day of December, 1891.

Other systems will be investigated if submitted.

The Mayor and Council reserve the right to reject any or all bids. H. P. Pirronnot, Mayor. Attest, Geo. E. Chappell. City Register.

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Sealed Proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock p. m. on the 30th day of November, 1891, for all the labor and materials required for the cut stone work and brick work, iron and wood floor and roof construction, roof covering, approaches, etc., for the superstructure, ready for the interior finish of the United States Court House and Post Office, at Springfield, Missouri, in accordance with the drawings and specification, copies of which may be had at this office, or the office of the Superintendent at Springfield, Missouri. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in an envelope, sealed and marked, "Proposals for the Cut Stone Work and Brick Work, Iron and Wood Floor and Roof Construction, Roof Covering, Approaches, etc., for the Superstructure, etc., ready for the interior finish, for the United States Court House and Post Office at Springfield Missouri," and addressed to W. J. Edbrooke, Supervising Architect.

Proposals.—Sealed proposals will be received at the office of the Illinois Board of World's Fair Commissioners, Room 18 Montauk Building, in Chicago, until 12 o'clock m. on the 18th day of November, 1891, for all the labor and material required for the erection and completion of the Illinois Building for the World's Columbian Exposition at Chicago in accordance with the drawings, general instructions, conditions, and specifications (copies of which may be seen at the office of the Commissioners in Chicago and on application to the architects, W. W. Boyington & Co., 157 La Salle street, Room 107, on and after Oct. 26, 1891.)

Each proposal, whether for a part or the whole of the work, must be accompanied by a certified check for a sum not less than 3 per cent of the amount of the proposal, drawn in favor of the Director-in-Chief of the Illinois Board of World's Fair Commissioners.

The Commissioners will reject all bids received after the time herein stated for opening the same, also bids which do not strictly comply with all the requirements of this invitation. The Commissioners also reserve the right to reject any or all bids. Proposals must be inclosed in sealed envelopes, including schedule of work and material and check, and marked "Proposal for the Illinois State Building for the World's Columbian Exposition," addressed to John P. Reynolds, Director-in-Chief of the Illinois Board of World's Fair Commissioners. This 15th day of October, 1891. W. C. Garrard, Secretary Illinois Board of World's Fair Commissioners.

NOVEMBER 21, 1891. The American Engineer. VOL. 22, NO. 21.

A NEW "C. AND C." DYNAMO.

The illustration on this page is taken from a photograph of a 50 H. P. "C. & C." dynamo of a type placed on the market by the "C. & C." Electric Motor Company, 402 and 404 Greenwich street, New York City, during the past summer. The design is similar to that of the well known circular field and consequent pole motor that has become familiar to the public, in fact there is not an electric light company in the country operating an incandescent circuit of any size that has not one or more of these motors connected to its wires. The machine represented in the cut is wound for 500 volts and specially designed for power circuits. For a long transmission of power this machine can be specially wound to give perfectly automatic regulation under the very greatest possible variation in load. A substantial terminal board is bolted to the upper pole piece and is provided with a heavy knife switch for opening the main circuit. This board also carries the field and armature connections, all of which are of solid metal and in plain view. The commutator is of the most substantial construction, being built up of heavy copper bars insulated with the best mica, and with proper care it will last for years. The mechanical construction is of the best throughout, skilled mechanics being employed with the most improved machine tools. The armature is wound to carry a much greater volume of current than the nominal capactity of the machine requires, thus making it practically impossible to burn them out by over heating. The circular shape of the magnets gives them the greatest possible deveiopment of power for least weight, and every part is so constructed as to make solidity and permanence the first consideration.

The 100 H. P. dynamo made by this company is of exactly the same form as the dynamo illustrated herewith and is especially suitable to be used as a power generator for street railways circuits, its high efficiency and mechanical excellence making it a favorite with station superintendents.

These dynamos are wound in standard sizes from 1 to 100 H. P. for electric lighting as well as for power transmission, and especially for isolated plants and for use in mills, office buildings, banks, etc.

Althongh the "C. & C." Electric Motor Company has but recently entered upon this field, the long list of parties now using their dynamos for lighting purposes is the best possible indication of the success they are meeting with.

Adjntant-Generals and other high officials of the National militia, appointed for the purpose by the Governors of the several States, met in Chicago last week to confer with Exposition officials with reference to the partlcipation which the militia shall have in the Exposition and in the exercises dedicatory of the buildings. About one hundred were present, representing nearly every State in the Union. Actlon was taken which, it is believed, will result in between 12,000 and 15,000 militiamen participating in the dedicatory exercises in October, 1892, and in a national encampment and grand review of 100,000 troops being held at Chicago in August, 1893, whlle the Exposition is in progress. Resolutions were adopted advocating a national encampment of the National Guard, embracing the militia in the several States, every ten years, at the expense of the General Government, and that tho first of such encampments be held at Chicago in 1893.

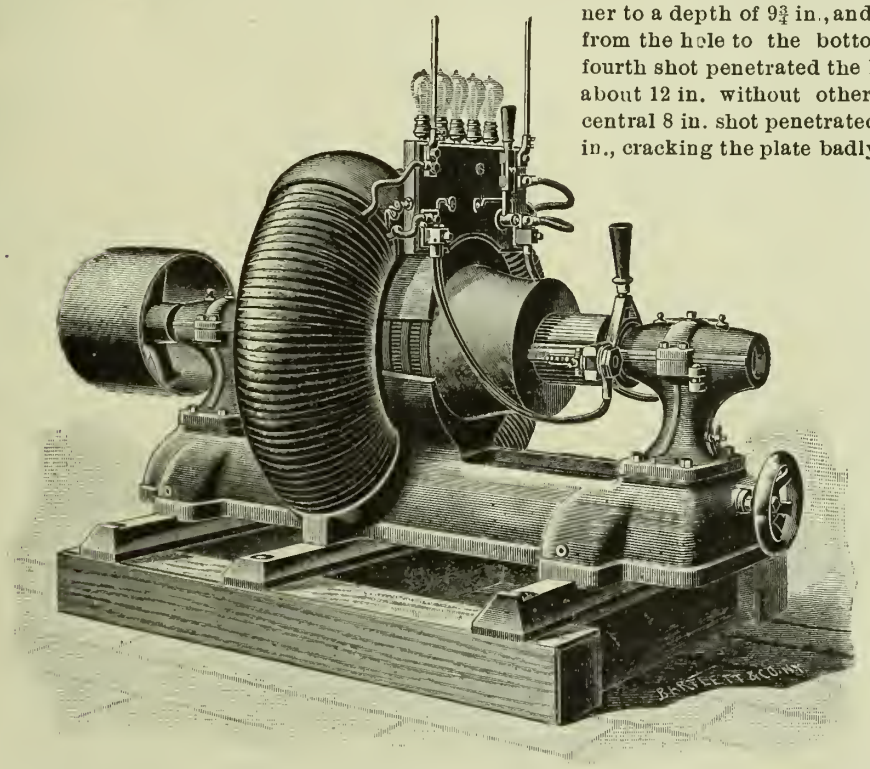
Director-General Davis and Chiefs Buchan an and Peabody, respectively of the Agricultural and Liberal Arts Departments of the Exposition, have held a conference with a number of gentlemen representing nearly fifty agricultural colloges and experimental statlons in the United States, regarding exhiblts, from such institutions. It was practically decided that a complete exporimental station, showing the work by students and tho results secured, will be established in connection with the Agricultural exhibit, and that the exhibit by the agricultural colleges will be made in the Liberal Arts Department.

Day and night shifts of men are now working on all the Exposition buildings.

TRIAL OF AMERICAN HEAVY ARMOR PLATES

The trial of heavy armor plates of American manufacture mentioned in our issue of Oct. 9, was commenced last Saturday, says *The Railroad Gazette* of Nov; 6, at the Indian Head Proving Grounds on the Potomac river below Washington, D. C. All the plates are 8 ft. × 6 ft. surface exposure by 10½ in. thick; three of them were attacked Saturday, one from Carnegie, Phipps & Co., of rolled, low-carbon, nickel steel, one from the Bethlehem Iron Co. of forged, high carbon nickel steel, and a second from the Bethlehem Co. of Harvy treated forged steel. The 6-in. 40-calibre gun was mounted with a muzzle at a distance of 57 ft. 6 in. from the plate, the 8-in. 25-calibre gun was mounted with its muzzle 54 ft. 2 in. from the plates. The projectiles used for the 6 in. guns were of the Holtzer imported type, 17¼ in. weighing each 100 pounds. A charge of 42 pounds of Dupont prismatic powder was used for firing the projectiles. The projectile used for the 8-in. gun was of the Firminey make weighing 210 pounds and fired with a charge of 74.5 pounds of Dupont prismatic powder. The velocity of the shot from the 6 in. gun was 2,075 ft. per second, that from the 8 in. gun was, 1,850 ft. per second. The results were as follows:

The Bethlehem, forged, high-carbon, nickel-steel plate was pierced at its upper left hand corner by



the first shot, the projectile rebounding to a distance of 15 ft. without injury. The depth of penetietion was some 13 in., fringed by a circular rise of about one inch in height. The width of bulge was 8 in. The second shot penetrated the upper right hand corner to a depth of 9.5 in. and broke up outside of the face of the plate. the fringe and bulge about the same as the first shot. The third shot penetrated tho lower left hand corner to the same depth as the first (13 in.), rebounding from the hole some 15 ft., with the loss of its band. The fourth shot penetrated the lowor right hand corner some 10¼ in., making a bulge 17 in. in width and producing two radial cracks some 3 to 4 in. long. The projectile rebounded with 9 in. of its length broken up. The fifth shot was fired from the 8 in. gun, at the centre of tho plate. The projectile penetrated to a depth of 15½ in., rebounding to a distance of 54 ft. Two cracks were tho result of this 8 in. shot, one radiating to the upper left hand corner and one to the lower left hand corner, each passing through the holes mado by proceding 6 in. shots. Tho upper crack was serious and extended through the whole thickness of the plate. A third crack crossed the spaco between the contre 8 in. shot holo and the uppor right hand 6 in. shot hole.

The first shot from the 6 in. gun at the rolled, low carbon, nickel-steel plate of Carnegie, Phipps & Co. penetrated the uppor left hand corner to a dopth of 11¾ in., and remained in place with similar bulge and fringe to Bethlehem plate. The second shot penetrated the upper right hand corner to a depth of nine in. and remained in place, and in comparatively good condition, similar to the first shot. The third shot penetrated the lower left hand corner, leaving only about 2½ in. of the base of shot sticking out. The other results were about the same as with previous shots. The fourth shot penetrated to a depth of 13½ in., and remained in place under the same conditions as before. The fifth shot fired from the 8 in. gun, at the centre of the plate, entered the plate completely, the base of the projectile being some seven-eighths of an inch below the face of plate. A crack showed itself extending radially from the centre 8 in. hole to the upper left hand corner, of plate, passing across the upper left hand 6 in. shot hole. The upper portion of this crack was much worse than that between the holes, though neither portion extended completely through the plate.

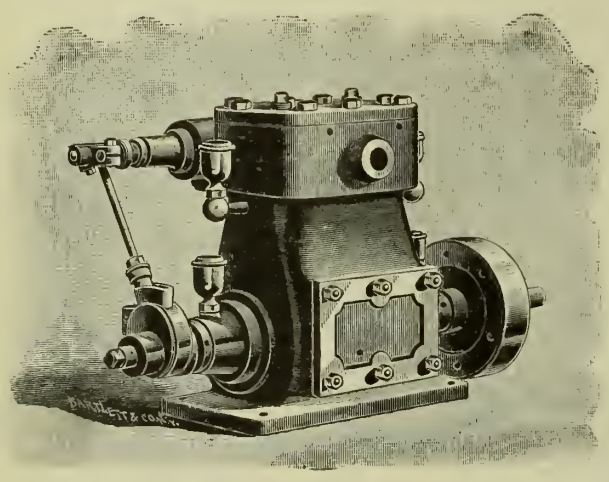
The first shot from the 6 in. gun at the Harvey, low-carbon, all-steel plate of the Bethlehem Iron Works penetrated the upper left hand corner about 7 in. and broke up, scattering the pieces in all directions. The second shot penetrated the upper right hand corner some 2½ in. and broke up. A crack resulted from this shot, extending horizontally in an upward direction to the right hand edge of plate. The third shot penetrated the lower left hand corner to a depth of 9¾ in., and caused a crack running from the hole to the bottom edge of plate. The fourth shot penetrated the lower right hand corner about 12 in. without other damage. The fifth or central 8 in. shot penetrated to a depth of about 23 in., cracking the plate badly, one crack extending from the lower left hand corner up through the lower left hand, the centre and the upper right hand holes, to the upper right hand edge of plate; another extending from the lower right hand corner diagonally upward to the lower left hand shot hole, and thence to the lower left hand edge of plate.

A peculiar result of the firing at the Carnegie, rolled, low-carbon, nickel-steel plate presents itself; that while the projectiles penetrated to a considerable depth, and deeper than in other plates, each remained in place as a perfect fitting tight plug. The cracking and breaking up of the Harvey, low-carbon, all-steel plate was quite unexpected. Whether this last result arises from defective treatment in its manufacture or not, the ability of the low steel, rolled plate of Carnegie, Phipps & Co. to stand fire so well will necessitate a new trial with new plates to confirm this new and quite important experience. The crack in the low-carbon plate, although but slight, needs further experiment and explanation before a settled conclusion is arrived at. Again, a comparison of the cracks in the high-carbon plate and the Harvey process plate may possibly show exposed hardness to be a bad feature of thick plates. A reversal of the Harvey plate might have brought about quite different results. The question of rolling versus forging is probably a feature of the problem, or again, the necessities of defense in different positions on the vessel may call for different construction of plates. The hard surface material produced by the Harvey process may be the more useful for portions of a vessel likoly to receive glancing instead of direct blows. There are still five more plates to be tried before final conclusions can be thought of.

The Department of Electricity is making an effort to secure a complete collection of historical electrical apparatus for the World's Fair, in order to show the progress of the science from early times.

THE EVOLUTION OF THE DIRECT-CONNECTED DYNAMO.

It is an interesting fact that the Westinghouse Machine Company was the builder of the first direct connected dynamos in the United States, if not in the world, if we are rightly informed. In fact, the idea of a direct-connected dynamo is responsible for the Westinghouse single-acting engine. In 1880 the Brush Electrical Company conceived the application of the electric arc for locomotive head lights. Belt transmission being out of the question, the problem of a direct engine was laid before Mr. H.H. Westinghouse, of Pittsburgh, for solution. The terms of the problem were stated about as follows: The speed must not be less than 1,000 revolutions, and the power developed not less than 1½ net horse-power. The engine must be able to stand up under 150 to 180 pounds of steam; it must be self-contained, so as to be bolted to the locomotive, like a brake pump; it must be sufficiently rigid, so as to stand all the shock and jar of service; it must be inclosed completely, as a protection from dust and cinders; and finally, it must be capable not only of several hours continuous running without attention and of continuous service day after day, but must be of such a design as to run for an indefinite time without any attention whatsoever, while the locomotive is side-tracked and the engineer absent. It is evident that the one solution possible was the single-acting, self-contained and self-lubricating engine.



First Westinghouse Steam Engine, A. D. 1880.

It is interesting to note that with no original thought beyond some special application of this kind, the above type of engine has propagated itself without essential modification until it has developed a business of the present enormous proportions involving compound and triple-expansion engines up to 1,000 h.p. The original engine, whose history we have recited, now fills with dignity the position of center piece in the office of the Westinghouse Machine Company at Pittsburgh.

A more serious attempt following the comparative success of the locomotive experiment was the constructing of several short-stroke engines developing about 10 h.p. for coupling direct to Brush machines at 800 to 1,000 revolutions. A number of these were built and operated successfully—one at least after ten years of service is still regarded as the most reliable engine in the experimental plant of the United States Government Torpedo Station, at Newport, R. I.

The single-acting engine has fairly proved its right of inheritance to this special trade. The primary idea of forcing an engine to an abnormal speed to meet the supposed demand of the dynamo was unnatural and wrong. The commercial conditions of electrical construction at that time prohibited any compromise, but the present state of electric art has changed all this, and the reasonable idea now prevails of cutting down the speed of the dynamo instead, to the normal speed of the engine. This is commercially possible within fair limits, and the single-acting engine with its natural capacity for high speed forms a complete solution of the problem.

Mexico has made a World's Fair appropriation of $50,000. This is only preliminary, however, and it is fully expected that the whole of the $750,000, which were asked for, and perhaps more, will be voted.

PROSPECTS OF ELECTRICAL ENGINEERS.

The *Electrical Engineer* (London) has published some interesting correspondence referring to the earnings of professional electrical engineers, as compared with the incomes of those following other callings. A Mr. Cuthbert Hall set the ball rolling. According to what he and others say, an engineer, even when highly educated and well taught in electrical science, passes rich on $500 a year.

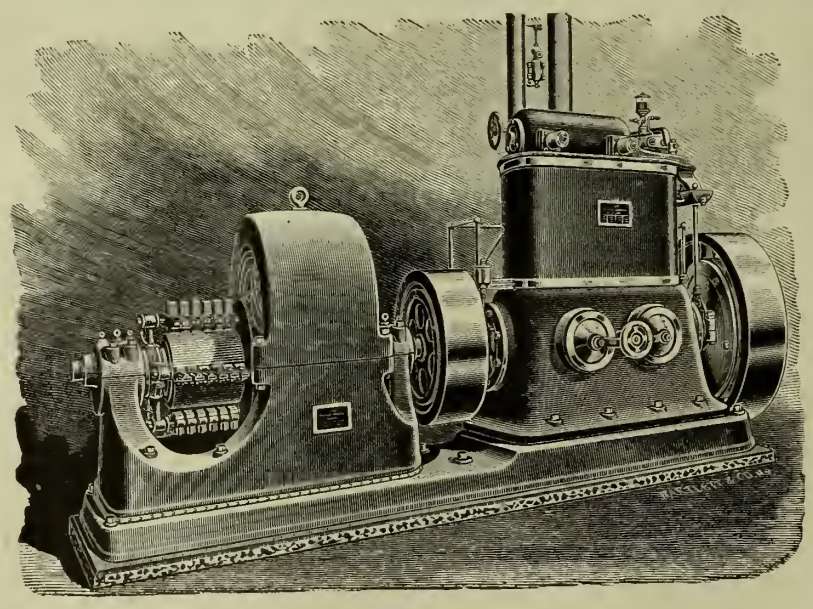
The discussion is doubly interesting to Americans.

The three "alternative" methods of training suggested are (1) a university course followed by an apprenticeship to a firm of electrical engineers, (2) an apprenticeship to a firm of electrical engineers only, (3) a one, two, or three years' course at a technical training college.

"Of these three courses, the former is undoubtedly the best," says Mr. Hall, and, while deploring the lowness of the wage, quotes presumably in support of his conclusions, the case of a gentleman who, after spending £800 on his education at Cambridge, where he came out fifth wrangler, and a further sum of £300 with a firm of engineers, is now in receipt of a salary of £100 (scarcely $500) per annum as the outcome of his six years' training. Assuming Mr. Hall to be perfectly sincere in the advice he gives, and that he really believes an electrical engineer must devote six years of his life and spend £1,000 for his training in order that an income of £100 a year can be earned, it will probably occur to most people that a single instance such as that given proves absolutely nothing, says Mr. Hugh E. Harrison. The only way of arriving at a just estimate of the relative merits of the three methods would be to trace the careers of as large a number as possible of men who have passed through them.

I am able to give some figures in the case of one method which I think may prove useful, says the last named correspondent. These are in connection with the electrical engineering college which formerly carried on its work in Red Lion square.

The course given extended over two years—the first year was spent in college, where theory was taught by means of lectures and experimental work in the various laboratories, while the second year was entirely devoted to actual engineering work with the company to which the college was attached. The life of the college was a short one; it ceased with that of the company, which, like so many others, fell a victim to the Act of 1882. It trained, however, a sufficient number of men to show the results to be expected from the course adopted. Of those whose names appeared on the books, 29 per cent. have been lost sight of, but of the remainder, no less than 72 per cent. are still in the profession, some doing well on their own account, others holding responsible posts. I do not, of course, know what incomes these gentlemen enjoy, but most, if not all, certainly get a good deal more than £100 a year.

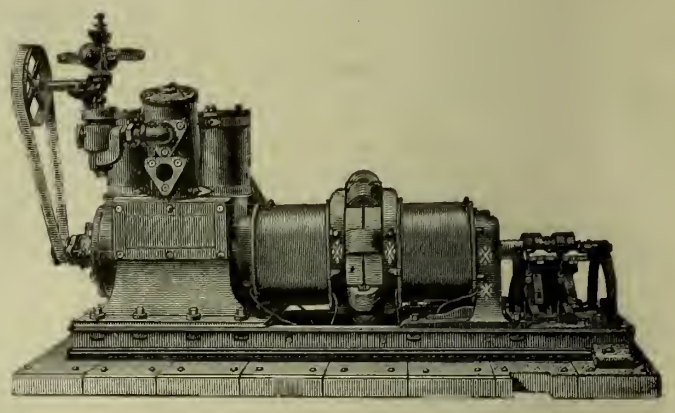


The Present Westinghouse Electrical Generator.

With much that Mr. Hall says I thoroughly agree, and if space permitted, I could give curious particulars as to the qualifications of a vast number of so-called electricians. Returning, however, to the unfortunate wrangler, Mr. Hall has, as so many people do, simply considered the training and entirely overlooked the characteristics of the man himself.

A fifth wrangler must either be a mathematician of no mean order, or he must possess extraordinary powers of cramming for examinations. At Cambridge the education of such a man, owing to the rich endowments, need not cost him anything; he may, on the contrary, make his education a source of profit. A man like this, who will not, or cannot, look after his own monetary interests, is not likely to be of any service, from a commercial point of view, to the firm which employs him, and the £100 a year must probably be regarded as a charitable gift to a person who has mistaken his calling, rather than as a salary for useful services rendered.

Another correspondent, named Sydney F. Walker, writes as follows on the remuneration of young electrical engineers:—



First Direct-Connected Dynamo, still in use at the U. S. Government Torpedo Station, Newport, R. I.

Mr. Cuthbert Hall's complaint is an echo of the complaints one has heard from young men just starting in every profession, as far back as one can remember.

The young parson, after quite as expensive an education, and with often quite as good abilities, finds himself, at the age of 23 or so, privileged to wear the glossiest of black coats and the whitest of ties on the magnificent income of perhaps £80 per annum, and with the additional calls upon his purse entailed by visiting the poor.

The young schoolmaster is the same, the young naval and the young military officer also. Nor have the juniors of any of these professions any extraordinary incomes to look forward to in the immediate future. The curate perhaps serves a vicar who administers to the spiritual wants of a large parish and to the temporal wants of a large family on the magnificent income of, say, £250 per annum, with perhaps an Easter gift and a few presents thrown in, and without the smallest prospects of ever being anything else but vicar of the same parish on precisely the same income. The schoolmaster sees men who have been schoolmasters for a score of years getting incomes of £150 or £200. The naval officer sees many of his brother officers that are old enough to be his father getting incomes of from £200 to £300, and that only on condition that they keep two homes, spend several consecutive years away from their families, and exist during the time they are at home on about one-third of the amount.

There are prizes, of course, in all these professions—archbishoprics, headmasterships, admirals of the fleet, and so on—but everyone cannot have them.

At present there are few such large prizes in elec-

trical engineering, because it is a new branch, but there are still plenty for those who can get them. As a matter of fact, however, it may be taken that £300 a year is a good average income in these times for a highly-edncated man in almost any of the professions, and that any youngster, no matter what his parents may have spent on his education, mnst be content to begin at something very small—usually less than the figure Mr. Hall's friend receives—and work his way up gradually, as opportunity offers. In electrical engineering there will be plenty of good prizes for men of skill and perseverance as time goes on.

But it may be asked, is it any use to educate a lad? Why not let him go as apprentice at 13 or 14 years, and work on that way. The answer is, the education given to a lad in his youth, provided he makes a proper use of it in after years, determines the position he will be able to take, should the opportunity offer, as a man. In these days, under no conceivable circumstances can an uneducated man attain to a leading position in any branch of engineering. The case is very much like many that are met with in mannfacturing. A particular kind of clay, for instance, that is used for high-class pottery may be used for inferior work, or a particular piece may be spoilt in the course of manufactnre, but under no circumstances could an inferior clay have been made into the highest-class work.

So, too, a particular ingot of steel may be rolled into rails worth a few ponnds per ton, or it may be drawn out into watch springs worth over £1,000, bnt inferior steel could not be made into the latter.

This, then, is the sole end of the education a youth receives—viz., to fit him, or, rather, to enable him to fit himself, for the higher position he may occnpy later in life if circumstances are favorable. This being so, however, is it not wiser to limit the amonnt spent on education to the probabilities of the futnre position that the youth may hope to attain. If a working-man could afford the expense. it would snrely be unwise for him to send his son to Cambridge, or even to keep him at school during the years that might be more profitably employed in learing his trade.

And this brings one to the question: Is it wise, under ordinary circumstances to incur the expense, and to spend the time necessary to take a degree at Cambridge?

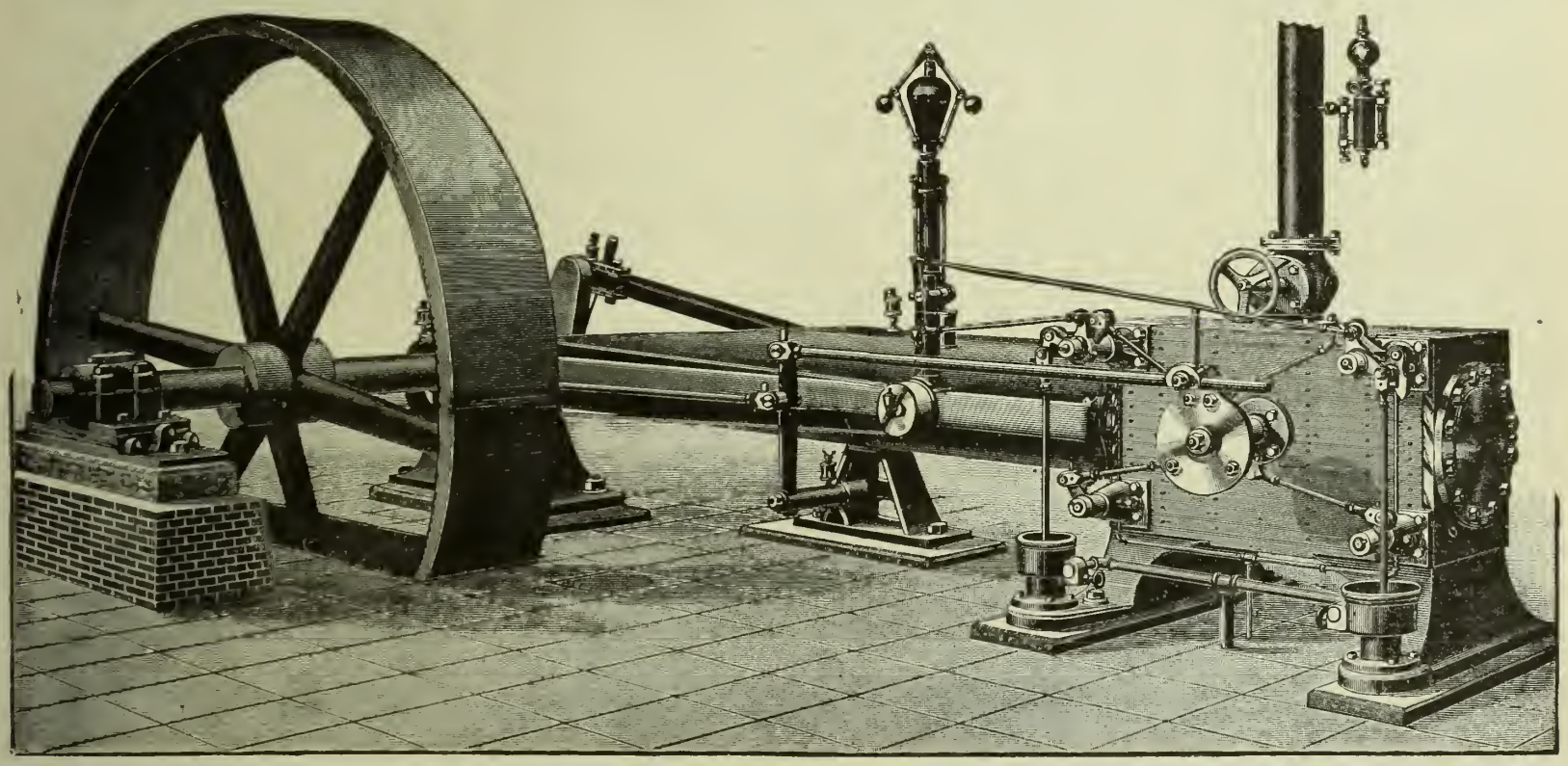
The answer to this must be dictated by the particular conditions of each case. If a young fellow's parents or friends can launch him at a higher level than others have to take; or can look forward to giving him the necessary opportunities that will enable him to reach the highly-paid places without the struggles that others have to make; or if there be particular conditions which render it probable that he will be able to place himself on this higher plane, then the money and time will be well spent. But in the vast majority of cases, parents will not

Continued on Page 210.

THE SIOUX CITY CORLISS ENGINES.

Below we give a cut of the Corliss engine built by the above named company, who claim to have the largest engineering plant west of the Mississippi river, devoted exclusively to the manufacture of high grade engines and complete steam plants, with a capacity of turning out 150 engines annually. They have recently built and equipped new shops at Leeds, Iowa, (Sioux City's manufacturing suburb), with a view of making a specialty of this line of work. The old shop, tools and fixtures, so long known for the past twenty years, has been sold off, and all lines of business dropped except the manufacture of high grade engines. Their location is one that gives them the best shipping facilities; being in the doorway of the west and northwest, they are admirably located for supplying the wants of that trade.

Mr. Giddings, president of the Sioux City Engine Works, for seven years, before coming west, had entire charge of the engineering department of Russel & Co., of Massillion, Ohio, and came to Sioux City over three years ago and took an interest in this company. They at once commenced the building of the Giddings' automatic engines, so well known at the east as the Russell, and since that time they have been combining the manufacture and sale of both types of engines. This has given them such a decided advantage over the trade that several of the best engine salesmen throughout the west and on the Pacific coast have applied for the handling of their goods. For the past two years they have been obliged to run both night and day through the six months of the busy season, and their yearly output nearly doubles that of the previous year.



About six months ago they established a branch office at 48 South Canal street, Chicago, Ill., with Mr. S. K. Gregg, as manager, and since that time, they have sold 14 large engines east of the Mississippi river. As will be seen elsewhere in our columns, they have recently opened a branch office at Room 511 Commercial Building, corner of 6th and Olive streets, St. Louis, Mo., with Mr. A. M. Morse as manager. Mr. Morse was formerly connected with the firm of English, Morse & Co., Kansas City, Mo., and has been long and favorably known to the trade. Negotiations are now in progress for establishing branch houses in several other large western cities with a view of doubling their out-put the coming season. During the past two years the company have built some special machinery, adapted to duplicating the parts of their engines, increasing the quantity of work, and at the same time improving the quality of the same. Among their other large tools, they have a fly-wheel lathe that turns a 24 ft. wheel with a 4 ft. face.

The cut herewith shows their new design of Corliss engine bed, which has, by the way, already been remodeled and re-designed with special reference to weight and stiffness of bed in order to adapt them very perfectly to the heavy and fluctuating loads of electrictric lighting and railway service. This engine they build from 50 to 500 h. p., and their slide-valve automatic engines from 30 to 150 h. p. This, together with the manufacture of high grade boilers, and heaters, complete their line of work.

By referring to the cut, it will be noticed that the design of their bed is of the very stiffest pattern; extra material having been placed in it near the pillow-block, to insure the best degree of stiffness to resist strains due to over-hang. The mainbearing pedestals and cylinder feet are from three to four times as heavy and broad as those of the old patterns, thereby giving a far better bearing on the foundation and a greater degree of stability and rigidity. In the outer pilow-block, they provide for vertical adjustment, the convenience of which will be readily appreciated by all practical engineers. The guides for the beds are all bored on independent centres, giving the very best kind of quality as well as the very best extent of wearing surface. This special device, built at their own works, gives a deep guide which readily holds the crosshead in line with the cylinder.

The new descriptive circulars issued by this company shows that in the design of their cylinder, they have provided an independent exhaust passage beneath the cylinder, with dead air space between the cylinder proper. The steam is taken between the valves (not over them), and the most improved hook-motion valve-gear is used. The next noticable feature of this Corliss engine is one that has gained for it its wide reputation in electric lighting, viz., its governor which is far superior to anything heretofore offered by Corliss engine builders, they maintain. Many of their engines are working in electric lighting stations, varying less than 2 per cent. from extreme heavy to light loads. This they guarantee in every instance where their engines are used for electrical work. This enables the electric lighting stations to get the long-sought-for economy of the Corliss, together with the extremely close regulation of the high speed engines. As will be seen by referring to their descriptive circulars, they are building these engines in all the popular sizes up to 500 h. p., either in simple engines, tandem, or cross compound condensing engines. In point of economy, they appear to stand unexcelled. The Giddings' automatic engines are too well known to need a detailed description here; they being the same engine as built by Russell & Co., of Massillon, Ohio, of which many hundreds are now in use in electric lighting stations. The valve used in these engines is the Giddings' equilibrum slide valve, of which there are over 8,000 in use in different kinds of engines, some of them having been in use for the past ten years and the case of re-planing or scraping a seat of a cut valve has never been known. Additional information can be had by addressing the company.

The American Engineer.

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Contents of this Number.

Rain makers have not yet really relieved the water famine in New York City, by replenishing the Croton water shed or any other way. The *World* has offered to pay the expenses if Dyrenforth will bring "the gentle rain from heaven." Owen Glyndwr "called the spirits from the vasty deep," but they did not come. Dyrenforth may play such pranks before high heaven as to make angels weep, and operate his rain-making scheme, but will the rain come? Not at the demand of Dyrenforth, we think.

Engineers are more alive than ever to the necessity of educational efforts. Members of the A. O. S. E. are laying their plans in various councils to make marked progress in this direction this winter. The N. A.S.E. do not intend to be left. But the most remarkable indication of a waking up among stationary engineers comes from "outsiders," that is those who do not belong to any organization. It is now generally felt that it is a great advantage to fraternize with an order of engineers whose aim is to elevate the profession generally and improve the condition, circumstances and surroundings of their members individually as well as collectively. It is by combined efforts that most may be accomplished, although individual exertions are essential to success. It pays to exchange ideas.

Newspapers manufacture strange reports when they play the "scooping" game. As soon as the New York *World* announced that it had invited Gen. Dyrenforth to come and make rain for the benefit of New York City, and offered to pay the expenses, the New York *Commercial Advertiser* prepared a neat little scheme to forestall its big contemporary, and when rain did come (subsequent to the change of weather, all over the country, after the eclipse on the moon), the *Commercial Advertiser* boldly announced that the rain had been produced by James Pain's Sons who sent up bombs (of some secret composition) over Croton Lake. The New York correspondent of the Chicago *Tribune* says, "The rain making firm of James Pain & Son says that its bombs produced the rain, or at least some part of it." It is said that an egg-shaped bomb went up, and that its exposion was heard twelve seconds later, and that twenty seconds after "a slight fall of rain began." There were more explosions, and more rain. But it really looks as if the rain would have come (in the Croton watershed, as it did in other places) if there had been no bombs exploded. And reliable evidence is yet lacking to show that any bombs were exploded at all.

FATAL BOILER EXPLOSION.

Joliet, Ill., which is within a few miles of Chicago, was shocked by a terrible boiler explosion at half past six o'clock on Monday morning. One of the five boilers in the barb-wire factory of the J. R. Ashley Wire Company exploded killing the fireman, John McSweeney, instantly, and tearing the boiler-room to pieces. The explosion was heard all over the city, houses within a half mile of the factory having windows broken; and the sound of it was heard five miles distant.

The building, which is an immense one, was wrecked from end to end with a loss of $75,000. The boilers were run by crude oil and were insured by a boiler company for $20,000. The same company insured the life of the fireman for $5,000, it is said. But the reason for such a scheme is not explained.

Neither is there any explanation given as to the cause of the explosion. The boilers were officially inspected two weeks previously.

CHICAGO ENGINEERS' LICENSING LAW.

Since the publication of the Engineers' Licensing Ordinance, at Buffalo, N. Y., in our last issue, it has been suggested that we also publish the ordinance governing stationary engineers in Chicago, so that those working for licensing laws in other cities may know the details of a licensing system which has been in operation over eighteen months. The provisions of the Chicago licensing law is as follows:—

An Ordinance

For the examination and licensing engineers in charge of steam machinery and steam boilers in the City of Chicago.

Section 1. There shall be appointed by the Mayor, with the consent of the Council, a Board of Examiners (which shall consist of three members) of competent and practical engineers, good judges of construction of steam boilers and engines generally, and experienced in their operation and uses, whose duty it shall be to examine each applicant, in pursuance of rules and regulations of this ordinance, and if the applicant is found qualified, the examining engineers shall sign a certificate of qualification which shall be delivered to such applicant, such certificate to expire one year from the date of issue.

Sec. 2. Said Board of Examiners shall be provided with suitable quarters by the Commissioner of Public Works. Said board shall make and enforce such rules and regulations for its government and that of its employes as may be deemed proper and desirable, not inconsistent with the provisions of this ordinance and the general law. Said board, or a majority thereof, shall hold stated sessions once each week, of such duration as may be deemed requisite between the hours of 9 a. m. and 5 p. m., for the purpose of examining and determining the qualifications of applicants for licenses for engineers.

Sec. 3. The Board of Examiners, or a majority thereof, shall have power to examine into the qualifications of applicants, to grant licenses, and, for cause, to suspend or revoke the same. Every application for a license must be made on the printed blanks furnished by the Board of Examiners, and that for an engineer must be accompanied by a fee of two dollars ($2). All licenses shall remain in force for one year from date of issuance, unless suspended or revoked. Any license expiring by limitation may be released to the same person upon payment of fee without examination, as provided in Sec. 6.

Sec. 4. An applicant for an engineer's license must be a machinist or engineer, having at least two years' practice in the management, operation, or construction of steam engines and boilers. He must state upon the blank the extent of his experience; must be at least 21 years of age, a citizen of the United States, or have declared his intention to become such; must be of temperate habits and good character, all of which must be vouched for in writing by at least two citizens of Chicago.

Sec. 5. The Board shall have power to suspend the license of an engineer for permitting water to get too low in boiler; for carrying a higher pressure of steam than limited by law; for an absence from his post of duty; for permitting an undue volume of smoke to issue from the boiler chimney or stack, or for any violation of the provisions of this ordinance, or other neglect or incapacity; *provided*, however, that no license shall be suspended or revoked without first giving an accused party an opportunity to be heard in his own defense. When a license of an engineer shall be revoked, no license shall be issued to the same person until after the expiration of six months, and then, only upon full compliance with the conditions and provisions prescribed for an original license. In case of suspension or revocation of a license, the fee thereof shall be forfeited to the city.

Sec. 6. Every certificate or license issued to an engineer shall be signed by the majority of the Board of Examiners, sealed with an imprint of the Board's seal, and attested by the Clerk.

Sec. 7. The Board of Examiners shall cause to be kept in suitable books a full and correct detailed record of its official proceedings, including the names of the members of the Board, the names, age and residence of all applicants for licenses, the number issued and rejected, the number of licenses suspended, renewed or revoked, the cause therefor, the names of the persons forfeiting licenses; also the full amount of money received, and that returned on rejected applications. The financial record must be balanced daily, and the result thereof, in writing, shall be deposited daily with the City Comptroller.

Sec. 8. If any member of the Board of Examiners or any person or employe connected therewith, shall at any time, or under any pretense whatever, himself, or through any other person or persons receive, or cause to be received, any money, gift or other valuable thing or consideration, except as herein provided, for the purpose of officially favoring any applicant, or for the purpose of deceiving or defrauding any person or persons, or shall issue a license authorizing any person or persons to act as engineer without first having examined and found him or them qualified for such service, in accordance with the provisions and conditions of this ordinance, then, in such case, the member or members of the board, or other person so offending shall be removed from office by the Mayor, and ever after be debarred from holding any position, official or otherwise, in the service of the City of Chicago, and any applicant who shall himself, or through any other person, offer, or caused to be offered, any money or other valuable consideration to said board, or any member thereof, or any person connected therewith, for any official act or favor, shall ever after be debarred from receiving any license under this ordinance.

Sec. 9. No steam engine or boiler subject to the provisions of this ordinance shall be used, managed or operated in the City of Chicago, except by an engineer who shall have been duly licensed as provided in this ordinance, and who shall have and exhibit a certificate thereof. Any person who shall take charge of, manage, or operate any steam engine, boiler, or any portion of a steam plant in the City of Chicago without a proper and valid license, as provided by this ordinance, shall, for each and every offense, be subject to a fine of not less than twenty dollars nor more than fifty dollars, and any person, agent, firm, company, or corporation owning or controlling any steam engine, boiler, or other steam plant, who shall authorize or permit any person or persons without a proper and valid license

to manage or operate any portion of a steam plant, shall, for each and every offense, be subject to a fine of not less than fifty dollars nor more than two hundred dollars.

Sec. 10. It shall be the duty of the Board of Examiners to see that each boiler plant in the City of Chicago shall have a licensed engineer in charge at all times when working under pressure, whose certificate of qualification shall be displayed in a conspicuous place in the engine room, and each engineer shall devote at least eight hours out of every twelve, while boilers are working under pressure, to the duties of the plant under his charge.

Sec. 11. Every engineer licensed under this ordinance, shall, within the first ten days of January and July respectively, of each year, make a written report to the Board of Examiners of the condition of the engine, boilers and steam apparatus comprising the plant under his charge. All additions or changes made in any plant must be reported by the engineer to the Board of Examiners within ten days thereafter.

Sec. 12. The engineers in charge of locomotives shall be exempt from the provisions of this ordinance, and all boilers used for heating private dwellings, hot-houses, conservatories and other boilers having more than one hundred square feet of heating surface, and carrying not more than ten pounds pressure of steam per square inch, and the persons operating them shall be exempt from the provisions of this ordinance. The police are instructed to report all infractions of this ordinance coming to their notice.

Sec. 13. Said Board hereby created shall not, in its salaries and expenditures exceed the amount received from license fees; shall quarterly yearly make a written report under oath to the City Comptroller of all expenditures, and pay over to the City of Chicago all balances in their hands. The salary of the Secretary of the Board shall be fifteen hundred dollars ($1,500) per year, and he shall devote his whole time to seeing to the enforcement of the provisions of this ordinance, and each of the other members shall receive a salary of five hundred dollars per year. In case the receipts from the licens fees shall be insufficient to pay above salaries and the legitimate expenses of said Board, their salaries above mentioned shall be dimmished pro rata to the amount of the deficiency.

Sec. 14. This ordinance shall be in force from and after its passage.

VALUABLE MINERAL DISCOVERY.

An important deposit of that rare metal known as vanadium has been found in the Province of Mendozra, Argentine Republic. This metal is one of the rarest and most valuable known, and is used for setting dyes in silks, ribbons, hosiery, and other fine goods. The principal source of supply until recently has been a small deposit in the Urai Mountains, and it has been sold as high as $1,500 per ounce. This newly discovered deposit in Mendoza will therefore be recognized as of great importance.

MECHANICAL TRAINING IN MEXICO.

The Executive has applied to Congress for authorization to spend what may be necessary for the purpose of establishing in the Federal District a school for the practical training of young men in the handling of steam engines in general, but more particularly of locomotives. This school will be under the the control of the Department of Public Works. The course of study will comprise the elementary branches of mathematics, mechanics and natural philosophy, mechanical drawing, French, English, etc., but its salient features will be the acquisition of a practical acquaintance with the materials of which steam engines are manufactured the mode of putting them together and taking them to pieces, of operating locomotives, practice in handling locomotives of pecular pattern,and instruction in the rules governing the running of trains. A period of training in railroad shops in foundries and mills will also enter into the curriculum. After satisfactory examination in the branches named pupils will be be given a certificate of fitness.—*Two Republics* (Mexico).

DANGERS OF LARGE FLY-WHEELS.

The bursting of the 68 ton fly wheel of the great engine in the Amoskeag mills, Manchester, N. H., furnishes additional evidence, if such were needed, to prove that with the means now at hand the possibility of flaws in large castings cannot be determined with certainty. In his testimony before the coroner's jury, the superintendent of the mill said: "The remnants of the fly wheel show very many internal flaws where the iron is drawn badly by shrinkage in cooling, all of which was impossible to discover without destroying the wheel; sounding would not show the flaws. If you join two cubes of iron of equal size, one solid, the other filled with these shrinkage flaws, the parts would vary largely in weight; such tests would be impracticeable in castings as large as the integral parts of this fly wheel." According to the testimony the wheel was moving at its usual rate, the same being 61 revolutions a minute, and this is strange enough when we consider that it has been in use over eight years for about three months each year, water power being employed in the interim. This, like all big wheels, was composed of segments bolted together, and, of course, it is possible that the trouble began on the rim, the bolts loosening and the component parts of the wheel, or those of imperfect make, being unable to withstand the shock of the wrenching that followed.

In another recent fly wheel catastrophy, that in the power house of the Electric Street Railway Company, of Cincinnati, O., the wheel, a twenty one ton, suddenly flew apart and at a time when, so far as the engineer could see, there was not any undue acceleration of the engine's movements.

In this case there were no casualities, as at Manchester, and hence no inquest. The investigation that followed was conducted by interested persons who, notwithstanding the declaration of the engineer, who was present at the time, attributed it to a sudden withdrawal of the load and the consequent racing or "running away" of the engine. The fact that the automatic cut-off, operated by the governor, was found to be intact might fairly be accepted as helping to sustain the assertion of the engineer, because, had the engine been relieved of its load, this automatic cut-off would undoubtedly have held the engine to within a few turns of its normal speed. It would seem, therefore, as if this, too, might be a case of defects in casting.

A recent inquiry among the makers of these big fly wheels failed to discover one among them who knew of any test for the large castings by which the presence of flaws, the result of air bubbles in moulding or improper cooling, could be discovered. About a year ago there was a report that a French inventor had devised a means of doing this by electricity, the apparatus being called a "schiseophone." It was said for it that it would indicate the presence of flaws in steel rails that the ordinary hammer test could not be relied upon to discover, or, to put it more correctly, that the human ear is not sensitive enough to read the warning that may be given in the hammer test when put to large castings. Nothing, however, seems to have come as yet of all the promises made for this invention. Till such or similar means are found to discover flaws in segments for large fly wheels, it is not safe to use them in the vicinity of workrooms, as at Manchester.—*Scientific American.*

Plans for the exercises dedicatory of the Exposition buildings during the week of October 12, 1892, are fast being matured. One of the chief features practically decided upon is a nocturnal procession of floats on the illuminated lagoons at Jackson Park. These floats will represent a chronological epitome of sallent historical events by centuries, from 1492 until the present time. Altogether there will be between forty and fifty floats costing perhaps $700 each on an average. The last one will represent Chicago welcoming the nations of the earth. All of the boats will fairly blaze with electric lights, and thousands of incandescent lamps under the water will give them the appearance of floating on a lake of fire. It is believed that fully 500,000 people will watch this gorgeous spectacle each night from the banks of the lagoon.

A STEAM RE-ACTION WHEEL.

Prof. J. Burkitt Webb, in the *Stevens Indicator* for October, dilates upon the performance of a steam re-action wheel, giving explanations of remarks made in connection with a "Note on the Steam Turbine" presented at the Erie meeting of the American Society of Mechanical Engineers.

The following are extracts from Prof. Webb's article in the current issue of the *Indicator*:

In the calculation of a steam re-actlon-wheel there are two things which threaten to make the computation of no value unless they are taken daly into consideration. These are the change in density and wetness of the steam as it escapes through, and the increase of pressure from centrifugal force as it approaches, the orifice. If, however, these things are properly treated, the remaining calculation is quite simple. We will discuss essentially the same problem as before, viz.: a 15′ H. P. re-action-wheel of one foot diameter, with a speed of 4,000 revolutions per minute, and a boiler pressure of 70 lbs., or less, absolute.

To separate these two things, and thus be able to treat each by itself, we will suppose that the pressure of steam is 70 lbs. absolute and the steam saturated, just inside the orifice, where the contrifugal force has produced its whole effect. The boiler pressure will then be less than 70 lbs. by the amount due to contrifugal force, and this will not be so great as to require more than at first, or at the most a second, approximation thereto.

Evidently the increase of pressure will be no more than the centrifugal force of radical column of steam 6 inches long 1 inch square, with a density at its outer end corresponding to 70 lbs., and at its inner end corresponding to the boiler pressure. For the first approximation suppose steam to weigh $\frac{1}{6}$ lb. per cubic foot, which corresponds to 70 lbs. pressure, then the whole column, containing $\frac{1}{288}$ of a cubic foot, will weigh $\frac{1}{1728}$ lb., which, being divided by $g = 32.2$, gives .000018 of a unit of mass. For every 1.000 revolutions per minute that the wheel may make, the circumferential velocity will be about 52½ feet, and the angular velocity twice that, or 105, and, as the radius to the centre of the column of steam is ¼ foot, the centrifugal force of the column of steam is — centrifugal force = (angular velosity)^2 × radius × mass = $105^2 \times .25 \times .000018 = \frac{1}{20}$ lb., and this would be somewhat greater than the increase of pressure be cause the density of the column of steam is less toward the centre.

For greater speeds we should have: For 2,000 per minute $\frac{4}{20} = \frac{1}{5}$ lb., for 4,000, $\frac{16}{20}$ or $\frac{4}{5}$ lb., for 16,000, $\frac{256}{20}$, or say 12 pounds. Therefore, at 4,000 revolutions the boiler pressure would not be a pound less than the nozzle pressure, and no more accurate estimate of the centrifugal force is needed, while at 16,000, if the effect of the decreasing density of the column toward the centre is to be allowed for, it will reduce the difference of pressure calculated above about 5%, leaving a difference of over 11 lbs. between the boiler and nozzle pressures.

We come now to a more important part of the calculation. It is not enough to know from a formula how much steam will escape through a nozzle; the way in which it escapes has an important influence on the power developed.

In speaking of this pressure as existing at the entrance to the nozzle, a slight reservation must be made, so as to allow for the velocity past that point. This velocity is comparatively small; suppose, for instance, that the cross-section at the point indicated is 10 square inches, while the smallest or "throat" section of the nozzle is 1 square inch, then about 1 pound of steam per second will pass and its velocity will be only 86 feet per second, to produce which a fall of pressure of two ounces would be enough, or if the section at the point was only 5 square inches there would be a required fall of a half pound or produce the necessary velocity of 172 feet. The 70 lbs. then is 70 lbs. for still steam.

The speech making, choral exercises, etc., will occur in the Manufactures Building, which will be fitted with seating accommodation for 80,000 to 100,000 people. It is now thought that from 12,000 to 15,000 troops will participate in the dedicatory exercises. The expense of the dedicatory ceremonies will approximate $200,000.

PROSPECTS OF ELECTRICAL ENGINEERS.

Continued from Page 207.

only not be conferring a benefit on their sons by giving them a Cambridge education, they will be doing them a positive injury.

The three years spent at college, however well employed, will not do them one-tenth part of the good for their future work that the same time properly employed in practical work would have done. Living, as articled pupils in electrical engineering works do, in an atmosphere of electricity, they will have very little trouble in acquiring a sound knowledge of theory by reading up in their evenings, if they will. And their knowledge is all the sounder for being constantly subject to the check of practical experience. After a man has left college, too, he is usually too old to teach in the same way as he could have been taught at 17 or 18. Often he thinks he knows more than those placed over him, often he has much to unlearn. His college life also, continued as it it is right up to early manhood, tends to unfit him for the rough work in which the best experience is obtained. And when he emerges from his articles at twenty-three or twenty-four years of age, for the greatest part of the work that he may be called upon to do, he is of no greater value than the young man who was articled at 18, although he may be a Cambridge wrangler. His Cambridge education will help him to calculate to a nicety the resistance of the magnetic circuit of a dynamo, but it will be very little help to him, without practical experience added, when the dynamo perversely refuses to give a current, or a telephone refuses to speak.

But it may be asked, is there any advantage to be gained by adopting the profession of an engineer, as against other professions? The answer is, Yes; there are more opportunities to be taken advantage of than in other professions. A curate may preach like an angel, yet, unless he has a relative or friend, or influence, a curate he will remain all his life.

An engineer, however, and particularly an electrical engineer has many ways of making opportunities of showing his knowledge and skill, and of forcing his way to the front by what our American cousins call "sheer grit." That is the great advantage apart, from the fascination of the work, of belonging to some branch of engineering.

Before concluding, it would be as well to point out that very few fortunes, if any, have been made in electrical engineering pure and simple. The fortunes that have been made have been due in nearly every case to lucky strokes of finance, not to engineering, and it is in part due to some of those fortunes that salaries are low, and dividends non-existent. The business of an electrical engineer is a very expensive one to carry on, principally on account of the very rapid advances that are being made, and the absolute necessity of keeping abreast of them. Also, it is an error, as commercial men well know, to suppose that neither ability nor education are necessary for responsible positions in the commercial world. It will possibly sound like rank heresay to proclaim the fact in an engineering paper, but it is nevertheless true that the ability required for responsible positions in commercial life is of a very much higher order than is requrired for engineering. That this is so is proved by the fact that the highest salaries are paid to, and the largest fortunes are made by, the clear-headed, cool men of business. One word more. As Mr. Cuthbert Hall will know well, the salaries of young or of old engineers are ruled by the same law of supply and demand that governs every other transaction in our daily life.

The supporting columns for the Forestry Building are to be trunks of trees with the bark on Chief Buchanan has requested each State to furnish three trunks of trees for this purpose. Arkansas, California, Colorado, Connecticut, Illinois, Indiana, Iowa, Maine, Minnesota, Montana, Nebraska, New Mexico, Pennsylvania, Texas, Wisconsin, Washington, and West Virginia have promised to furnish their quota.

Underground conductors of electricity to operate electric street railways are working successfully in Germany. The system is to be "imported" (free of duty) into Chicago, on the North or West Side street car system, under the Superintendence of Engineer A. W. Wright.

CORROSION IN STEAM BOILERS.

At a meeting of the Society of Engineers in the Town Hall, Westminster, London, Nov. 2, a paper on the above subject was read by Mr. J. H. Paul. He first dealt with the molecular structure of iron in its two different forms of *a* iron and *b* iron, and the hardening effects of manganese and carbon, and touched briefly on the principal chemical properties of iron, including the action of caustic alkalies and the occlusion of gases by the iron. A short account of the manufacture of boiler plates led to the statement that the "vagaries of corrosion" is merely another way of saying that the molecular arrangement of the particles being invisible, it is impossible to say where the soluble particles lie, that is to foretell the particular spots where most solution will take place. Metals are collections of molecules massed together by fusion and pressure, and the very fact that they are seldom found free in nature, points to the conclusion that in their free state they are in an unable state of equilibrum, and, therefore, ever ready to enter into fresh combinations.

The second part of the paper was devoted to corrosive natural waters, and the rain water was traced from the sea to the steam boiler, the various causes which influence its character being briefly alluded to. Special reference was made to the Huddersfield tramway explosion, and the causes pointed out; the following analyses of the waters and deposits being given:—

No. 1.—Feed Water.

	Grains per gallon.
Sulphate of Lime	2.94
Sulphate of Magnesia	1.04
Chloride of Magnesium	0.18
Chloride of Sodium	0.85
Silica	0.30
Oxide of Iron	0.29
Free Hydrochloric Acid	0.46
	6.06

No. 2.—Boiler Water after Three Days.

	Grains per gallon.
Chloride of Calcium	2.00
Sulphate of Magnesia	1.53
Sulphate of Soda	1.34
Sulphate of Iron	1.39
Chloride of Sodium	0.18
Silica	0.45
Free Hydrochloric Acid	1.53
Grease, Organic Matter, etc	7.40
	15.82

No. 3.—Ordinary Deposit from the Water.

	Grains per gallon.
Ferric Oxide	57.52
Basic Sulphate of Iron	2.28
Sulphate of Lime	38.47
Silica	1.48
Magnesia	0.25
	100.00

No. 4.—Deposit in Copper Patched Boiler.

	Grains per gallon.
Ferric Oxide	35.34
Ferric Hydrate	15.25
Basic Sulphate of Iron	12.28
Oxide of Copper	12.52
Silica	11.56
Magnesia	0.80
Sulphate of Lime	12.29
	100.04

Corrosion caused by alkaline artesian well waters was next described and illustrated by the following analyses:—

No. 5.—Artesian Well Water.

	Grains per gallon.
Silica	0.57
Bicarbonate of Iron	1.14
Carbonate of Lime	5.14
Carbonate of Magnesia	1.51
Nitrate of Magnesium	0.06
Bicarbonate of Soda	15.69
Sulphate of Soda	21.71
Chloride of Sodium	17.60
	63.42

No. 6.—Boiler Water at end of a Month.

	Grains per gallon.
Caustic Soda	163.24
Carbonate of Soda	703.79
Sulphate of Soda	1129.56
Chloride of Sodium	1167.08
Nitrate of Sodium	3.28
Organic Matter	4.75
	3171.70

A simple method of testing the total solids from day to day was described, and the following extract from actual practice given:—

Date.	Boiler.	Total Solids in Grains per gal.
July 3	No. 1	330
" 15	"	1060
" 18	"	360
" 24	"	560
" 27	"	430

Referring to the corrosion in marine boilers, the author illustrated the exciting condition of the water in the marine boilers, using sea water as a make up, by an analysis, and showed how much a solution would rapidly corrode iron and dissolve zinc.

No. 7.—Marine Boiler Water.

	Grains per gallon.
Chloride of Calcium	58.42
Chloride of Magnesium	570.40
Chloride of Sodium	5749.98
Sulphate of Magnesium	468.67
Silica	29.61
	6277.08

Cylinder oils were then shown to be liable to oxidation by high pressure steam, and the only organic acids thus produced act upon the metals of the engines and so introduce copper and lead into the boiler, and form insoluble soaps with the lime and magnesia in the boiler water. These magnesia soaps (the composition of which is given below) are very bad conductors of heat, and by getting baked on to the plates cause overheating and subsequent collapse.

No. 8.—Cylinder Deposit.

Mineral Oil	29.92
Combined Oily Acids	1.90
Carbonaceous Matter	8.90
Oxide of Lead	3.60
Oxide of Copper	1.12
Oxide of Iron	52.66
Oxide of Zinc	0.17
Lime	0.13
Silica	1.19
	99.59

No. 9.—Oily Deposit in Marine Boiler.

Magnesia Soap	35.78
Basic Sulphate of Iron	10.25
Oxide of Lead	0.23
Oxide of Copper	0.30
Oxide of Zinc	0.41
Magnesic Hydrate	47.56
Magnesia	4.90
	100.20

After a short description of the action of zinc, the paper concluded with an analysis of a piece of perished zinc taken out of a marine boiler.

L. Takaqui and K. Ikeda, two representatives commissioned by the Mikado of Japan, have been in Chicago seeking detailed information concerning the Exposition. They were greatly pleased and said their country would make a fine exhibit, and that in it would be a number of the private art treasures of the Mikado.

The Catholic church in Chicago wants to make an exhibit at the Fair, and has applied for 75x75 feet of space. The exhibit, according to the request, is to consist of, first, kindergarten work; second, primary grades; third, grammar schools; fourth, colleges and academies; fifth, industrial schools, orphanages, and deaf and dumb institutes.

Henri Moser, of France, wants to rent, for $10,000, a collection of relics from Central Asia, the result of five expeditions to that country. He values the collection at $40,000 and says it contains a large assortment, from firearms to embroideries and groups of statuary, all gifts of the sovereigns of Asia.

MECHANICS MADE EASY.

By F. A. Smith, C. E., M. E.

The three words forming the above headline cover a great deal of ground and the writer is well aware that the snbject must be handled carefully in order to present it in such shape so as to make it useful and interesting matter for the readers of the American Engineer; a good engineer is always a close stndent of nature and especially of matters and phenomena which directly enter into his occupation and in this matter at least nine-tenths of our readers have gathered a practical knowledge of natural sience covering the entire field in a successful manner; although they may not know the scientific names or formnlas which express certain important apparitions in nature, they fully understand their importance as affecting the execution of their work.

The object of this treatise is not to present a college treatise or mathematical mechanics, but will be carefully confined to language which can be understood by any ordinary intelligent reader and will strictly show the application of the natural sciences to machine and engine work.

Everything upon this world can be subdivided into three great divisions namely: solid bodies, such as earth, steel, wood; or fluid bodies, such as water, oil, quicksilver or vapors; gaseous bodies, such as air, gas, steam, etc. There are certain properties which are shared by all bodies, no matter, whether they are solids, fluids or vapors. These properties are:

(1.) *Extension* which means that all matter occupies space, a fact needing no fnrther explanation or demonstation.

(2.) *Impenetrability*, which means that two bodies cannot occupy the same space at the same time.

(3.) *Weight*, which means that all bodies, solid, fluid and vapors have a certain weight, cansed by the attractions of the earth of which we will speak later on.

(4.) *Mobility*, which means that the position of any body can be changed by the application of sufficient force.

(5.) *Inertia*, which means that all bodies have a tendency to remain in the state in which they are, or, in other words, a body that is at rest cannot change from rest to motion unless acted upon by an outside force and a body in motion cannot come to rest unless acted upon by some force; this latter assertion may look as though it was not born out by our every day experience, for we know that if we push a car along on a level track it will run a short distance and will soon be at rest; but if we look npon the snbject a little closer we find that the motion of the car is stopped by certain forces; as the car moves along, it has to displace the air which offers resistance; its motion is also counteracted by the friction in the rnnning gear of the car and the friction upon the rails.

(6.) *Divisibility*, which means that all bodies can be cut into smaller parts. This is self evident and requires no further comment.

(7.) *Porosity*, which means the matter composing the different bodies is not entirely solid, but that small vacant spaces exist between the smallest parts (called atoms or molecules) of the bodies. There are qnite a number of bodies where we can see these pores with the naked eye, but most bodies have pores so small that they cannot be seen by the naked eye, such as iron, steel, gold, etc. It has, however, been demonstrated that even gold has pores and experiments have proven that water can under high pressure be pressed through solid gold.

(8.) *Compressibility* or *Contraction*, which means that all bodies can occupy smaller spaces when acted npon by pressure or decrease in temperature; this is a well known property and is a direct consequence of porosity for as matter in itself is unchangeable in size, contraction affects only the pores which are becoming smaller under pressure or lower temperature.

(9.) *Expansibility* or *Expansion*, which means that all bodies under the influence of higher temperature will occupy a larger space; this is also well kown and is also explained by porosity, the pores being enlarged by the heat and the bodies thus expanded.

(10.) *Indestructibility*, which means that the matter composing the different bodies cannot be destroyed, neither can it be enlarged. This assertion will also require some explanation; for every reader will know at once of hundreds of phenomenas where bodies actually entirely disappear; for instance take a piece of ice in the summer and let it lay exposed to the warm air and we will see that it melts and gradually disappears; but by studying the process we find that the ice has been converted into a vapor by the heat of the sun, and this vapor has mixed with the air.

Also the burning of a substance does not destroy the matter, but only changes the different parts of the same, so if a cigar for instance is smoked, the remaining ashes and the expelled smoke contains the matter which originally made up the cigars.

ENGINEERS' YARNS.

The following roundhouse stories are going the rounds of the papers just now:

"Don't take much coal to run a machine nowadays," said Panhandle Dan, partly to himself and partly to "the gang" in the roundhouse, after studying intently a blue print upon the grimy bulletin board, upon which was set forth the number of pounds and decimals of a pound of coal burned per mile run by each engine on this division in the month of July.

"Git so by-and-by," he continued, after a final scrutiny of the blue print, "that a few matches and the glow of the engineer's nose will make steam enough to take a train over a division."

"It's a sin the way these fellers waste good cash testin' fuel savin' devices," argued The Corpse. "What they spend in experiments would pay every one of us 10 cents a mile and have money left. And these schemes to save coal don't amount to anything; I've tried it myself."

"You?" exclaimed the gang in chorus.

"Yes, me," returned The Corpse. "I've got my patent to show for it over at the boarding-house, too. Now I knowed that with the powerful draught of a locomotive a big percentage of the coal goes out through the stack in gas and half burned cinders and is wasted, so I goes to work to figger out how to stop that waste at the front end. It didn't take long and it was the simplest thing in the world.

I laid my plan before the master mechanic and he equipped an engine with one of my patents right off. All we did was to extend the smokestack by means of a couple of elbows back over the boiler, down through the roof of the cab and into the fire-box again. According to my theory all you had to do was to put in a fire and the smoke would jest keep a-goin' and a-goin' through that circuit until it was all consumed."

"And did it work that way?"

"Worked too well. When we got the darned thing started once we could never git her stopped so's to cool her off for washing out and repairs. One fire kept that engine red hot until she jest wore out and went to pieces like the one-hoss shay."

Intense silence reigned for two minutes. Then Rainbow Chase, deciding, after mental calculation, that there was no possible chance of borrowing a chew of tobacco from Panhandle Dan, remarked:

"Arizona's the place to save fuel. Down there on the N. G. in that sand the sun shines hot enough to keep an engine a sizzin' all day without using a shovelful of coal."

"Do you mean to say they run engines on sunshine down there?" interrupted Innocent Dougherty.

"Well, I should say—a—er—yes, they could run stationary engines that way, but the N. G. road is so blamed crooked that it keeps the engines dodging about so much the sunshine can't strike 'em more'n half the time. Why, there's one piece of track so crooked that it can't lay still. Sectionmen have to stand on the ends of the ties to hold it steady so's trains can pass over it."

"Gentlemen," spoke up Truthful Sam Adams, "I want to go on record as holding that economy is not only mighty inconvenient for them as has to practice it, but it is a mockery and a delusion on general principles; I've had some experience. When I was a young runner I was pulling freight out in Nebraska. One day I had a full train and a raw fireman and the natural result of the combination was that we struck on the first big hill we come to. I made a few remarks and then tried to slack 'em over, but it was no go. I hated to double, for it was four miles and over another hill to a side track, so I leaned back and thought awhile.

"There was a farmer distributing green cottonwood lumber for a fence along the top of the cut, so as soon as he was out of sight I sent the fireman up after a board and the brakeman back to the way-car for the switchrope. You all know what stuff to warp green cottonwood is. Well, we laid that board down lengthwise between the rails, hitched the switchrope on one end of it and then to the pilot drawbar and waited. In about two minutes the sun began to get its work on that board and she started to curl up. It took the slack out of that switchrope and then the train began to come; it had to.

"Gentlemen, in five minutes more we'd warped that train up to the top of the hill without touching the throttle or pulling a pin, saving an hour's time and half a tank of coal."

"That was a great scheme, wasn't it?" said Innocent Dougherty, admiringly.

"O I don't know. A cloud came over the sun just as we got to the top of the hill, giving us a splendid chance to cut loose from that board. We tossed it to one side and were just pulling out when the sun jumped out from behind that cloud. That board gave a flop the other way and doubled up, knocking the whole bloomin' train into the ditch, just like you've seen a whale in the picture-book smash a boat with its tail. It killed the fireman and two brakemen, crippled the conductor for life, and scattered my lunch in the dirt and cinders."

"That was pretty tough."

"Yes, I had a piece of cherry pie that day made of cherries that I sent clear to Chicago for. Cost me a dollar express charges. There ain't nothing nicer than a piece of cherry pie unless its two pieces of cherry pie. Have the cherries good and ripe and put in plenty of sugar——"

"Any you gentlemen know Garnie Shea?" queried Panhandle Dan. "No? Garnie went down to Texas about 'steen years ago to take an engine on the Waydown and Bangup. Have nigger brakemen and firemen down there altogether, you know. The nigger they put on with Garnie was a great strappin' sassy buck that thought he knowed more'n the man that invented railroads. Used to tell Garnie how to work his engine, how much throttle and how much quadrant he ought to give her, and so on. Well, naturally, seein' Garnie was a little high-spirited, they didn't get along first-class; they quarreled like married folks, and kept an eye on each other all the time for fear of gettin' slugged.

"One day they was bowlin' along over the prairie when a thunder-storm commenced gatherin' over 'em. Garnie and his nigger was each lollin' out of his winder watchin' the clouds when there came an awful clap of thunder, and a bolt of lightning struck the engine, paralyzing them both for about two minutes. They both come to at the same time and each thought the other belted him with the coal-pick when he wasn't lookin.' 'Course it made 'em both awful mad to think they had been taken advantage of, so Garnie grabbed a soft hammer, the nigger took the monkeywrench, and they went at it, and they didn't stop until the nigger was too dead to fight any longer.

"Garnie wasn't used to livin' in the South and he felt worried about that nigger, so he jest opened the door and chucks him into the fire-box. Garnie when right along with his train thinkin' he'd call over a brakeman to fire her in as soon as he could fix up a story to account for that coon. But the old mill kept runnin' along and seemed to keep hot, so he didn't do anythin'.

"Gentlemen, he was about forty mile from the end of his run when this happened and he took his train in without puttin' in another fire. That nigger made steam equal to half a tank of coal. Garnie was a curious sort of chap, always trying some project or other, so he thought he'd experiment a little. So as soon as he got out o' sight of town the next day he poked his new firemen into the fire-box and when he'd burned low he called over the head brakeman and chucked him in, and then after a while the hind brakeman. He found after thorough trials that three good, fat niggers would take a full train over the division in fine shape, equal to three tanks of coal in fact, besides steamin steadier and bein' easier on the engine. He was feelin' real good over his discovery until the offi-

cials noticed there wasn't any coal tickets comin' in for his engine and started an investigation."

"Did they hang him or send him up for life?" inquired the horror-stricken corpse.

"Hang who? Garnie Shea? Huh! While the officials of the Waydown and Bangup were considering whether to discharge Garnie or make him Vice-President of the road some of those Southern gentlemen got on to what he'd been doin' and elected him to Congress on the spot."

"Gentlemen," said Rainbow Chase, getting down off the pilot on which he had been sitting, and dusting his clothes with the palm of his hand, "I think I heard the bell ringing for supper over at Codfish Campbell's."

NEW ENTERPRISES.

ILLINOIS.

Chicago.

Francis J. Norton has among other work drawing on the boards for an eight-story apartment building, 50x85 feet, to be erected on Michigan avenue, near Thirty-eight street, for J. J. Meath and Allen H. Fitch. The exterior will be built of rock-faced granite for the first three stories and pressed brick, stone, and terra cotta for the five upper stories: The main entrance arise in a Moorish arch to the second story.

The second story has an open lobby the same width as the lower arch, and the massive Moorish arch windows adorned with projecting towers. The interior will be finished in cypress and oak. The building will have seventeen bath-room outfits, electric bells, electric elevator, speaking tubes. dumb waiters, mail boxes, and steam heat, stationary mirrors, stained, cut and beveled glass, and all that educated taste can desire. The outlay will be $100,000. Mr. Norton has also completed drawings for a twelve-room double residence for H. Matison, to be erected on West Chicago avenue. It will be built of frame and stone, bath-room outfittings, electric lights, speaking tubes, hardwood and oil finish, with all modern improvements. Cost $6,000.

W. L. Pierce & Co. have formed a company,which will purchase the property fronting 300 feet on Fifty-first street, 178 feet on Carroll avenue, and 86 feet on East End avenue for $100,000. It will then erect a six-story hotel at a cost of of about $500,000 for which Bemen & Parmentier have plans. R. P. Smith & Co., who own the land, are interested in the company.

L. G. Hallberg has designed for Ole Berg a five-story factory to be built at the corner of Carroll avenue and Ada street. It will cost $25,000.

Henry Ives Cobb has let contracts for addition to apartment building at the southeast corner of Maple and North Clark streets, 70x125 feet five-story and basement. The front will be of pressed brick with stone dressings, etc. Cost $50,000. Also plans for the office building to be erected on the southwest corner of Madison and Dearborn streets for the Hartford Deposit Company, 50x90 feet, fourteen stories high. The lower stories will be of granite, and above will be used stone, brick and terra cotta in combination. The building will be carried after the modern fashion upon a framework of cast iron and steel, the building of strictly fireproof construction throughout. The hall and corridors will be paved with mosaic and have marble wainscoting. A number of quick service elevators will give service to all the floors, and the latest improvements will be introduced. The cost is placed in the neighborhood of $500,000.

O. H. Postle has completed plans for a large laundry to be built at Nos. 386 and 388 Winchester avenue for Goodhart Bros. It will cost $10,000.

Jenney & Mundie have prepared drawings for warehouse premises to be erected on Clinton street, on the corner of alley running between Randolph and Lake streets, for Phillips & Co. The building will have a frontage of 60 feet and a depth of 80 feet and consist of five stories and cellar. Cost, $50,000. Also home for the Holland Society of Turners, 50x120 feet. Cost $35,000.

Thomas Hawkes is taking figures on a four-story addition and remodeling building at Nos. 1519 and 1521 Wabash avenue, for the Jones-Primly Company. Cost $25,000.

James G. Cozzens and others, by adding to their lease of ground at the northwest corner of Lake avenue and Forty-seventh street, have now 140 feet on Lake avenue, 186 feet on Forty-seventh street, 275 feet on the Illinois Central R. R., the north line being 213 feet. The entire ground with the exception of a spacious light court, will be improved with a building, to be known as the Kenwood. The building will be seven stories high. It will contain 300 rooms. The first story will contain the office, dining-room, etc. The cost is pl ced at $225,000. Plans have been prepared by Mayo & Curry. The company which will erect the building will be incorporated in a few days with a capital stock of $300,000, with Mr. Cozzens, F. L. Houghton, of Boston, and R. J. McDowell, of Minnesota, as incorporators.

The plans for the Lakota family hotel. to be erected at the southeast corner of Michigan avenue and Thirtieth street, have been drawn by Beers, Clay & Dutton. It is to be ten stories high. It will front 100 feet on Michigan avenue and 120 feet Thirtieth street.

The first three stories of the building will be faced with stone. The upper stories will be of light-colored pressed brick.

The building will contain 300 rooms, arranged in suites of two or more. The main entrance will be through the Michigan avenue frontage. The estimated cost of the structure is half a million dollars. Excavtions are now being made for the foundations.

Beer, Clay & Dutton have plans under way for a number of important buildings. For Noah Bond they have designed five three-story houses, to be built at the northwest corner of Madison avenue and Fifty-first street. They will be constructed of stone and brick, will be beautifully finished in hardwood, and will cost $40,000. Bids for construction are now being received. For C. J. Adams, of Boston, they have planed a four-story apartment house, 50x70 feet, to be built at No. 3535 Indiana avenue. It will be constructed of buff-colored pressed brick relieved by stone strimmings. The interior will be in hardwood. Steam heat will be used. The building will cost $25,000.

Louis Martin has about completed plans for a four-story and basement apartment house for A. J. Toolen at the northeast corner of Greenwood avenue and Forty-fourth street, fronting fifty feet on the former with a depth of 100 feet on the latter. The exterior will be of pink stone in the first story with terra cotta brick in the upper stories. The front will be relieved by copper bays. The interior will contain sixteen apartments of six rooms each, all finished in hardwood, heated with hot water, supplied with fuel gas, and lighted by electricity. It will cost $37,500, and work will be commenced as soon as the contracts can be let.

MICHIGAN.

Red Jacket, Lake Superior, is going to have an electric car line.

Lake Superior Iron Co. are going to build two steel boats.

South Haven will put in water works system, taking water from Lake Michigan.

Saginaw.

M. Merrill will put in a new engine and boiler.

Swift Electric Light Co. will put in an additional boiler.

Valley Machine Co. will put in a new engine and boiler.

Saginaw Union Street R. R. will erect a $25,000 building for power house, in addition to present plant.

Charlotte Mfg. Co., wants to put in a shaving and saw dust burner and plower.

OHIO

Cleveland.

The new hotel Pence will be opened about Dec. 1. It is situated at the corner of Superior and Spring streets. The office is on the ground floor. There is an electric plant in the building and all modern conveniences. The dining room will be large and well lighted. The large restaurant which has been so popular for many years, will be continued on the same plan. The hotel will contain 100 sleeping rooms, and the dining hall has a seating capacity of 260. American and European plans. S.

PENNSYLVANIA.

Philadelphia.

The new steel blooming mill at A. & P. Roberts & Co.'s Pencoyd Iron Works, along the west bank of the Schuylkill, opppsite lower Manayunk, is approaching completion. It is of iron, built upon foundations of Conshohocken stone, 400 feet long, 100 feet wide and 30 feet high to the roof eves. The roof is of slate, and is broken with a wide gable on the front. The mill will be known as the "36-inch mill," that being the diameter of the iron rolls, which are seven feet long.

The entire machinery will be hydraulic, supplemented by an overhead electric railway and a 30-ton electric crane, to be used for handling the steel. There will be two horizontal reversing engines of 2000-horse power, connected to a single shaft and geared to the mill. The governors will be hydraulic, a novel thing, in the fact, it is said, that they have never been known before. The product will be 500 tons of steel a day, all of which will be used in the firm's construction shops. The improved machinery will add much to the capacity of the works.

The rolls, used for rolling out the large ingots of steel, when heated to a cherry red, weigh 12 tons, and, by the electric crane, can be lifted out and replaced by another set in two hours.

The engines will have 40-inch cylinders and 60-inch stroke, requiring a steam pressure of 100 pounds. Gas will be used for fuel and heating purposes.

Reading.

The Reading Rolling Mill Company has received the contract to furnish all the iron and steel work to put up Machinery Hall, on the grounds of the Columbian Exposition at Chicago, and this firm will practically put up this immense building. This insures busy times at the establishment from now until 1893.

Heere & Koch have purchased a lot at Eighth and Oley streets, Reading, and are putting up a three-story cigar factory, 40 by 100 feet, which will employ, when finished, 250 hands.

The National Brass Works has purchased a plot of ground along the Lebanon Valley Railroad on the outskirts of Reading for the erection of an extensive plant. The brass department will be a building 50 by 75 feet, the foundry 60 by 124 feet, and the warehouse and factory, three stories in height, 40 by 100 feet, with an annex 20 by 12 feet.

WHO WILL BE THE WINNERS?

The American Engineer Publishing Co., with the view of bringing up the circulation of the paper to fully 20,000 copies each issue, offer a premium of $40 to the one who will send in the greatest number of new subscriptions, $20 to the one who will send the second greatest number, and $10 to the one who sends the third greatest number of new subcriptions, by January 1, 1892.

Three women have been appointed in Dutch Guiana to collect a display for the women's department, and in Mexico and quite a number of other countries provisions for women's displays are being made, for the World's Fair.

The women physicians, pharmacists, and dentists of Illinois intend to prepare an exhibit to be made in the Illinois State building of the Exposition.

The Daughters of the American Revolution have been granted 3,000 square feet for an exhibit in the Woman's Building. The organization, of which Mrs. President Harrison is president, has 1,000 members.

Miss Sara Bodtker, of Chicago, won the $50 prize offered by Mrs. Potter Palmer, President of the Board of Lady Managers, for the best design for a seal for that body. Nearly seventy women contested for the honor. Miss Bodtker's design shows a ship typical of Columbus' voyage, the eagle of loyalty, the ivy of friendship, the laurel of success, and stars equaling the number of Lady Managers. August St. Gaudens made the award.

THE WOMEN'S DEPARTMENT.

Thanksgiving Day.

Good, grand, old-fashioned Thanksgiving Day will soon be with us. Nothing can stop it. Says Dr. De Witt Talmage. It pressess on down through the weeks and months, its way lighted by burning cities, or cleft by cavernous graves; now strewn with orange blossoms, and then with funeral weeds; amid instruments that pipe "the quickstep" and drum "the dead march." Through the gates of the morning it will come, carrying on one shoulder a sheaf of wheat, and on the other a shock of corn. Children in holiday dress hold up their hands to bless it, and old age goes out to bid it welcome, asking that it come in, and by the alters of God rest a while. Come in, oh day, fragrant with a thousand memories, and borne down under the weight of innumerable mercies, and tell to our thankful hearts how great is the goodness of God. An aged Christian man in Massachusetts died not long ago, and instead of the flowers usually put on the pier, there was laid upon his coffin a sheaf of wheat, fully ripe. Beautifully significant! I wish that on the remains of this harvest year we might place on Thanksgiving Day a sheaf of prayer, a sheaf of thanksgiving, a sheaf of joy fully ripe! Emblems of joy and gratitude are never so appropriate as when they express our feelings on Thanksgiving Day.

How to Select a Turkey.

In this country only is the turkey found in a wild state. It is very fitting, therefore, that in the Thanksgiving dinner it should be the principal dish, writes Maria Parloa in her department in *The Ladies' Home Journal*. The turkey must be wisely chosen, well cooked and properly served. It should be short and plump, the meat white, with some fat, the legs black and smooth; and if there be spurs they should be short. The end of the breast-bone should be flexible, more like gristle than bone. A turkey that is long in proportion to its size, and has dark or bluish flesh, may be tender, but certainly will not be finely flavored and juicy. A dry-picked turkey will be found to have a much better flavor than a scalded one. All poultry that is dry-picked costs a few cents more a pound than the scalded, but is well worth the extra price.

To Serve with Turkey.

There are somethings that are understood by most people to be necessary adjuncts of the roast turkey, among them being giblet sauce, cranberry sauce, celery, and certain kinds of vegetables, says Maria Parloa in her department in *The Ladies' Home Journal*.

For a change one might have mushroom or chestnut sauce and currant jelly. The celery might be cut into pieces about three inches long and then cut into narrow strips, placed in iced water for two or three hours, and then served on a bed of ice. Here are some combinations of vegetables appropriate to serve with roast turkey or chicken.

Plain boiled potatoes, squash, cauliflower with white sauce.

Potato balls or cubes, with parsley butter, escaloped tomatoes, spaghetti with Bechamel sauce.

Plain boiled potatoes, escaloped sweet potatoes, mashed turnips, French peas.

Casserole of potatoes, creamed onions, Lima beans in white sauce.

Stewed celery with cream or Bechamel sauce, mashed potatoes, squash.

Escaloped cauliflower, potato timbale, vegetables a la jardiniere.

Plain boiled potatoes, squash, caullflower, with white sauce.

Potatoes, boiled onions in cream sauce, glazed sweet potatoes.

Macedoine of vegetables, potato croquettes, macaroni with brown sauce.

Women Doctors in Sweden.

There is only one woman doctor in Sweden, but several other women are studying medicine, though the time necessary to qualify seems appalling. It takes nine years from the date of the first examination.

NOVEMBER.

Like some fair woman who hath lost youth's charm,
Yet holds within her heart all goodly gifts,
November comes—worn pale by storm's alarm,
Borne down by clouds, yet showing thro' their rifts
Some hint of heaven's blue and sunshine's glow
Ere falls to earth her mantle soft of snow.

What matters then tho' hill and vale are bare?
She clothes them in a dainty garb of white.
Hangs every shrub with icy jewels rare,
And fills the land with echoes of delight
From merry sleigh-bells, and the rythmic beat,
Upon the frozen road, of flying feet.

So comes Thanksgiving Day—as it should come—
With cheerfulness and joy, and ringing bells;
With dear ones gathered round the hearth of home,
While thro' the land a happy chorus swells
Which speaks a Nation's praise to God above,
In thankfulness for His protecting love!

—Lee C. Harby, in *The Ladies' Home Journal*.

How Women Should Travel.

The subject of traveling in France or Switzerland or other Continental countries is entertainingly discussed by Mrs Fenwick-Miller in one of the London periodicals. Beginning with the assertion that two women may travel alone unattended, she says that everybody is most kind to English women who are thus journeying, and adds: "I cannot imagine that there should be any difficulty in the path of women of ordinary self-possession and common sense in traveling alone, provided they can speak a little French, and I counsel any of my readers who may have been waiting and wishing for years that some brother or cousin would convoy them to throw away their fears and plunge forth alone—that is to say, in that dual company which, as the adage tells us, is perfection. On such a journey very little luggage is essential. Big boxes are an endless worry. A small leather trunk or large portmanteau suffices. It should be big enough to hold a cotton dress, with an extra dress or two, say one thin and one warmer, and a dressy bodice for table d'hote, two complete changes of linen (which is enough for a long journey, as it can always be washed at short notice at the hotels) handkerchiefs, collars, writing materials, toilet articles, an extra pair of walking shoes, slippers, and dressing gown, and a few favorite medicines. A waterproof, a warm mantle, and a little shawl can be carried in a strap. Then, if a useful tweed or cloth traveling dress, a light cloak or jacket, and a straw hat or serviceable bonnet be worn, the traveler will find herself amply provided.

"Management is another important point. Either the tour should be completely planned out before starting with the aid of a guide book, and rigidly adhered to; or what is better, one person should be allowed to order the day's doings from day to day. Discussions and councils are apt to waste time and end in dissensions. The person who takes the management, however, must be unselfish and anxious for her comrade's satisfaction and pleasure; and the other must cultivate a sweet and calm temper, paying for her freedom from responsibility and care by patience when any little thing goes wrong, and by pliability of will for the time being. Given these conditions of mind—common sense and energy in the one and graciousness in the other, and affectionate kindness in both—I am convinced that a journey of two friends of the same sex is likely to be a more complete success than that of husband and wife, or brother and sister. The physical powers and the mental tastes are more likely to be similar in the former case. Your husband is bored to speechlessness if you take him for a day's shopgazing in Paris, or ask him to spend a few hours in the fascinating ateliers of Redfern or Worth. On the other hand, you are reduced to misery in Switzerland by what he considers an insignificant and wholly delightful day's walking. Your woman friend is at one with you under both circumstances. How often, when we have felt perfectly happy and satisfied with ourselves and our doings, we have seen and pitied the bored husband or exhausted wife! In short, so far from being impossible, it is a super-excellent arrangement for two women to take a Continental trip together.

The woman Lawyer.

By Mary A. Green, LL. B. *

A woman student of the law, whether in an office or a law school, has some pecular experiences. To a single woman among a class of men, the dilemma of the lectures as to a fitting mode of address is amusing. Most of them will gaze anxiously around, and, fixing the eye upon the lone female, with a slight bow will open the discourse with the word "Gentlemen." One professor was always careful and courteous enough to begin with the phrase: "Lady and gentlemen."

It is also amusing and gratifying to see the refining effect of the lady's entrance into the lecture hall or libray of the school. If the upraised masculine feet do not at once and voluntarily come down from the table top or back of the next chair, they are assisted to their rightful place on the floor by the hands of some fellow student. Of course there are always some men who heartily disapprove of a woman's presence within the walls of the law school, and are pleased to show their disapproval in any way short of actually rude conduct. I have never known of systematically rude behavior toward a woman law student.

When the woman lawyer puts out her shingle, or in modern fashion inscribes her name on the marble tablets at the entrance of her building, her first experiences do not differ much from those of her brothers who are just beginning. Perhaps she has a few more "cranks" among her first clients, who go to her because they "think they will get more sympathy from a woman." When sooner or later they have to be shown the door, their reproaches for her inhuman hard-heartedness are particularly severe, because they "expected better things from a woman."

Her clients are not, as many suppose, chiefly women. On the contrary she is more likely to be employed by men, who want to give her a chance to show what she can do. Therefore her cases are as likely to be questions of business contracts as controversies that are connected with matters popularly supposed to be within a woman's sphere.

When she appears in court the woman attorney finds the judges and attending counsel as courteous and as deferential as they would be in her drawing room. They will treat her as an equal, except that they will assist her by placing chairs, handing books and papers, and doing more favors for her than for her male colleagues. In fact they treat her very much as they would treat the distinguished legal lights of the age if they were within the bar, that is, with a deferential courtesy. This of course is only the case when the woman lawyer behaves as a lady. If she assumes a defiant and bullying manner, as if to demand special recognition, she will receive the treatment she deserves. But such conduct is, I am happy to say, extremely rare among our women at the bar, and is much lamented by others who are in public opinion weighed in the same balance with such misguided persons.

To Have a Bright Lamp.

In these days when lamps are used so much the care of them is quite an important matter, writes Maria Parloa, in *The Ladies' Home Journal*. If the lamps be good and have proper attention, one cannot wish for a more satisfactory light; but if badly cared for they will be a source of much discomfort. The great secret of having lamps in good working order is to keep them clean and to use good oil. Have a regular place and time for trimming the lamps. Put a folded newspaper on the table so that any stray bits of burned wick and drops of oil may fall upon it. Wash and wipe the chimneys and shades. Now take off all loose parts of the burner, washing them in hot soap-suds and wiping with a clean soft cloth. Trim the wicks and turn them quite low. With a soft, wet cloth, well soaped, wipe the burner thoroughly, working the cloth as much as possible inside the burner, to get off every particle of the charred wick. Now fill the lamps within about one inch of the top, and wipe with a damp towel and then a dry one. Adjust all the parts and return them to their proper places. Whenever a new wick is required in a lamp, wash

* In *Chautauquan*.

and scald the burner before putting in the wick. With a student lamp, the receptacle for waste oil, which is screwed on the bottom of the burner, should be taken off at least once a week and washed. Sometimes a wick will get very dark and dirty before it is half consumed. It is not economy to try and burn it; replace it with a fresh one. The trouble and expense are slight and the increase in clearness and brilliancy will repay the extra care. When a lamp is lighted it should not at once be turned up to the full height; wait until the chimney is heated. Beautiful shades are often cracked or broken by having the hot chimneys rest against them. Now, when ligting a lamp be careful that the chimney is set perfectly straight and does not touch the shade at any point. The shade should be placed on the lamp as soon as it is lighted, that it may heat gradually.

Women as Telegraph Clerks.

The Belgian telegraph authorities have decided that for the future no women may receive employment under the Telegraph Department. The reasons alleged for this step are that women cannot do the same amount of work as men and that their presence brings about a great many disadvantages. In Norway, however, the same difficulties do not appear to exist and twenty-five young women have been accepted as pupils at the forthcoming class for telegraphic clerks at the Christiania telegraph station. There were altogether seventy-four lady applicants for admission to the class.

LITERARY NOTES.

The Crocker-Wheeler Electric Motor Co., (430 W. 14th St., New York) have issued a second edition of their illustrated catalogue of the Crocker-Wheeler Perfected Electric Motors. The first pages contain illustrations of some of their special application, such as a motor and pump on one Shaft, and alternating dynamo built for the Columbia College Laboratory, Electric cloth cutter, Gatling gun operated by motor, etc. The Crocker-Wheeler Company are in the market for first-class work only. And the new edition of their pamphlet should be read and studied by all who contemplate using electricity.

Foundations and floors for the buildings of the World's Columbian Exposition, the subject of a paper read by Engineer A. Gottlieb before the Western Society of Engineers Nov. 4, has been issued in pamphlet form.

Mr. Gottlieb is chief Engineer of the Columbian Exposition, and also one of the most prominent members of the Western Society of Engineers. He has had many years experience in building bridges, trestles, roofs, and other structures of steel and iron, as well as of timber, and knows whereof he speaks when explaining the foundation requirements of the extensive temporary buildings of the World's Fair. The phamplet will offer interesting and instructive reading to those interested in the subject.

The University of Kansas has issued its prospectus of University extension, with a list of its lecture courses for the academic year 1891—92. Enquiries and all correspondence should be addressed to Chancellor F. H. Snow, Lawrence, Kansas.

Trap Siphonage and Trap-Seal Protection By Prof. J. E. Denton; pp. 56. (Reprinted from Vol. XVI of the "Transactions of the American Public-Health Association.) This pamphlet gives a detailed account of an extended series of experiments in trap siphonage conducted at the Stevens Institute of Technology, Hoboken, N. J. Two lines of waste pipe, 68 feet high, were erected, with branches from each on the several floors, to which various traps were applied and tested, and the results minutely recorded. These tests were intended to show the relative capacity and the degree of reliability to be attached to the several methods and means of preserving the trap-seal now known in plumbing practice. The phamplet contains much that will interest engineers, architects, plumbers and sanitarians. As a result of the experiments and observations made, Professor Denton arrives at the following general conclusions:

1. That 13½ ft. of 1½ in. wrough-iron pipe, with two elbows, will safely protect the seal of a ¾ S trap, having only ½ inch depth of seal, against the greatest suction siphonage influence which can be produced by any flow of water into a 2-inch waste-pipe of any height; but it is not a complete protection under certain conditions of back pressure

2. That a single 1½-inch McClellan vent affords the same protection as 13½ feet of 1½-inch pipe and two elbows against suction, and better protection against back pressure.

3. That either a 2-inch or 1½-inch McClellan vent at each fixture connection on a 4-inch waste-pipe closed at the top will protect a ¾ S trap with a 1½-inch seal against the greatest siphonage influence of any discharge occurring in plumbing practice in a 4-inch waste-pipe.

4. That the use of mercury in the McClellan vent can be relied upon to afford a reliable and indestructible seal.

5. That, therefore, the McClellan vent is a thoroughly-reliable protection against siphonage in any form of trap, and when used with a simple S trap forms a perfect self-cleansing combination which is proof against the most-severe siphonage influences arising in plumbing practice, including the complete stoppage of the tops of waste. pipes by ice.

6. That considering the liability of vent-pipes to stoppage by ice or rust, and the effect of upward currents of air in removing water from traps by oscillation (see Appendix), the ability of the McClellan vent to protect the seals of traps is superior to that of vent-pipes.

BUSINESS NEWS.

The Sioux City Engine Works of Sioux City, Iowa, have opened a branch office at St. Louis, Mo., Room 511 Commercial Building, corner of 6th and Olive Sts. The office will be in charge of Mr. A. M. Morse, recently of the firm of English, Morse & Co., of Kansas City, Mo., and who, during his eight years of residence in that city, has gained a wide acquaintance among the steam users of the southwest and has been awarded many important contracts for engines, boilers and complete steam plants for electric lighting stations, railways and manufacturing establishments. The Company are prepared to furnish on short notice Sioux City Corliss and Giddings' Automatic engines with suitable boilers, and make a specialty of complete steam power plants for any service.

The Pond Separator.

The St. Louis and SuburbanRailway, formerly a combined cable and steam railroad, but which has recently been changed to an electric line, has had some remarkable experiences at their new power plant. As in all electric railway stations, the work varies enormously, sometimes changing from nothing, to over 600 horse power, in less than one minute. This has caused the boilers to foam, or prime, and on two occasions, it is reported that the large Corliss engine would certainly have been wrecked, had it not been for the Pond separator, which is located in the main steam pipe, near the engine. Two additional Corliss engines are now being installed, and they also will be protected by the Pond Separator. This device for removing the entrained water from the steam, is manufactured by the Pond Engineering Co., St. Louis. They report additional orders from M. Beatty & Son, Welland, Ont.; Union M' f' g. Co.; Champaign, Ill.; Du Pont Paper Co.; Louisville, Ky.; Cicero & Proviso Railway, Chicago, Ill., two; St. Louis Smelting and Refining Co., St. Louis; and John Ramming, St. Louis.

RESPONSIBLE POSITION WANTED.

Mechanical Engineer, competent to design, construct, estimate cost, supervise erection, etc., of general machinery and wrought iron work, with practical and theoretical experience, desires a responsible position in any part of the country. Ad-M. E., care of the American Engineer, Pontiac Building, Chicago.

CONTRACTS OPEN.

Water-Works Franchise.—The city of Cape Girardeau, Mo., desires to let a franchise to a private company to build and operate Water-Works. Plans and specifications are now on file with the undersigned, and with Johnson & Flad. Consulting Engineers, Laclede Building, St. Louis.

Sealed proposals will be received up to 6 o'clock p. m. Monday, the 7th day of December, 1891.

Other systems will be investigated if submitted.

The Mayor and Council reserve the right to reject any or all bids. H. P. Pibronnot, Mayor. Attest, Geo. E. Chappell. City Register.

Water-Works.—Sealed proposals will be received until 3:30 P. M., Nov. 30, 1891, by the City Clerk of Hammond, Ind., for the construction of a system of water-works including the furnishing and laying of 25,750 lineal ft. of 16-in. cast iron pipe, and one vertical horizontal pump of 3,000,000 galls. capacity.

Plans and specifications may be seen, or obtained, at the office of the Engineer, C. McLennan, C. E., 308 Opera House Block, Chicago, Ill.

Firms bidding must give individual names and furnish certified check in the sum of one thousand dollars ($1,000) payable to the City Clerk which shall be forfeited to the city on failure to execute contract, in accordance with terms, if awarded same. The right to reject any or all bids reserved. Bids must be sealed and indorsed "Proposal for the construction of Water-Works." J. B. Woods. City Clerk.

Steam Heating.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until the 11th day of December, 1891, for all the labor and materials required to fix in place complete the low pressure, return circulation steam heating and ventilating apparatus for the United States Post Office, etc., building at Jackson, Mich., in accordance with the drawings and specification, copies of which may be had at this office, or the office of the superintendent at Jackson, Mich. Bids will be considered for any other system of heating and ventilating, in lieu of the above' and parties proposing to supply such must submit, with their proposal, plans and full specification for same. Each bid must be accompanied by a certified check for a sum not less than 2% of the amount of the proposal. Proposals must be sealed and marked "Proposals for the low Pressure, Return Circulation, Steam Heating and Ventilating Apparatuus (or otherwise, as the case may be) for the United States Post Office Building at Jackson, Mich.," and addressed to W. J. Edbrooke, Supervising Architect.

Sealed Proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock p. m. on the 30th day of November, 1891, for all the labor and materials required for the cut stone work and brick work, iron and wood floor and roof construction, roof covering, approaches, etc., for the superstructure, ready for the interior finish of the United States Court House and Post Office, at Springfield, Missouri, in accordance with the drawings and specification, copies of which may be had at this office, or the office of the Superintendent at Springfield, Missouri. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in an envelope, sealed and marked, "Proposals for the Cut Stone Work and Brick Work, Iron and Wood Floor and Roof Construction, Roof Covering, Approaches, etc., for the Superstructure, etc., ready for the interior finish, for the United States Court House and Post Office at Springfield Missouri," and addressed to W. J. Edbrooke, Supervising Architect.

NOVEMBER 28, 1891. The American Engineer. VOL. 22, NO. 22.

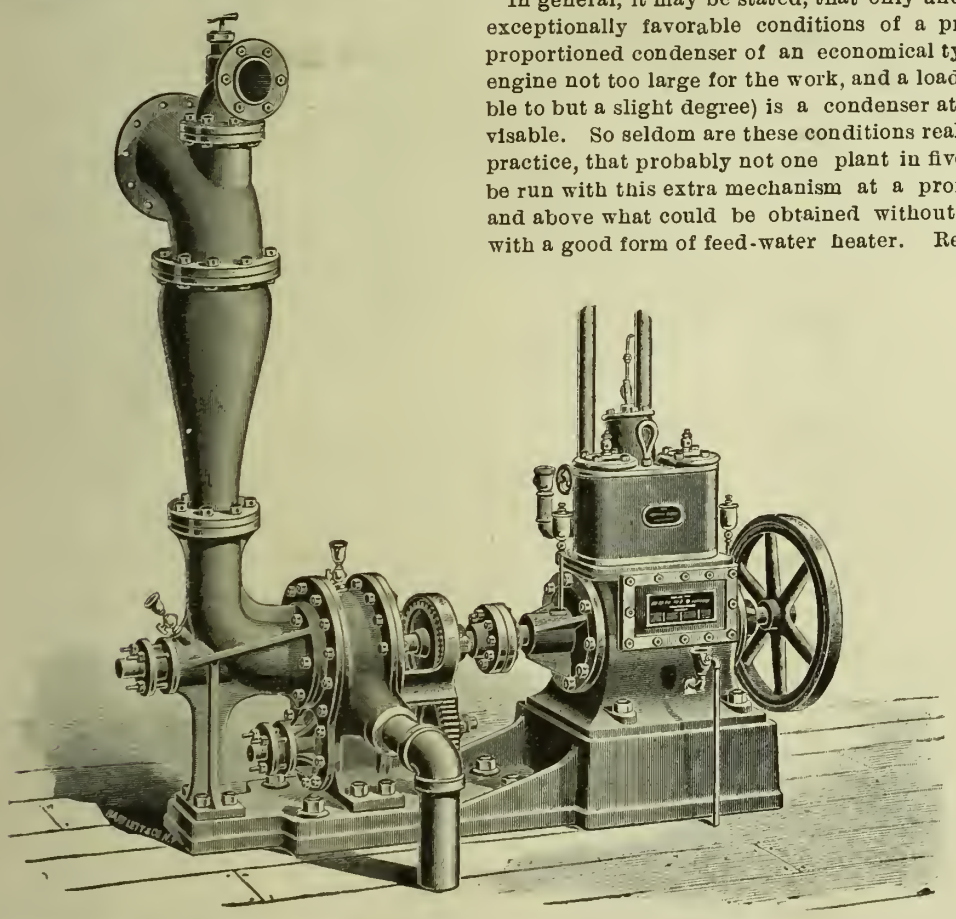
PLAIN WORDS ABOUT CONDENSERS.

In the early days of steam engineering, it is not strange that the condenser played such an important part. With the low steam pressures then available, a double advantage was secured, the capacity of the engine increased, while a greater expansion of steam permitted by its use, gave a much better economy.

The decreased steam consumption was comparative, however, and was so evident only by reason of the otherwise great waste if the steam were allowed to escape into the atmosphere after working at so low a pressure.

With higher steam pressures, a good degree of expansion was obtained without the condenser, and the economical performance of the engine correspondingly improved; while but a slight change for the better was shown with condensing engines at these pressures.

Theoretically, the gain in a cylinder should increase with the ratio of expansion; but, as a matter of fact, this is true only within certain narrow limits, and an expansion which yields a mean effective pressure less than half the difference of the extreme pressures will result in a loss from the excessive



initial condensation, which becomes greater as the limits are exceeded. Still, it is true that the economy does increase with the range of pressure and temperature in a cylinder if the expansion be not excessive, but this increase is so slight comparatively that the additional range through the vacuum is unimportant with a high initial pressure, particularly when it is remembered that the exhaust steam cannot be used for feed-water heating.

In the system of multiple expansion, the conditions are again changed. Here the low pressure cylinder subjects its steam to the same influences that gained the economy in the case of the single cylinder working with low pressures. By a division of the fall of temperature between the cylinders the internal condensation is reduced, and the value of the condenser again becomes probable. Even with this construction, however, a total net gain is by no means certain, and circumstances may very easily cause a considerable loss in its use.

Leaving out of the question the very important consideration of the cost of installation and maintenance of a condensing plant, and its liability to derangement, we shall deal only with the conditions which have a direct bearing on the consumption of fuel, the principal one of these conditions being the relative cost of operation of the condenser.

The greatest expense is the loss of heat for feed-water, which is constant, and in round numbers amounts to about two-thirds of the gain by condensing. The remaining third is the quantity subjected to varying conditions which may easily make a vacuum a dead loss. For instance, the quality of the work done by the engine has a most important bearing in this connection. With a variable load—as in electric and similar industries—the capacity of the condenser must be sufficient for the greatest demand upon it, so that at the average load, when the expansion is already too great for economy and the steam consumed in forming the vacuum is the constant amount for the maximum power of the engine, then the net result is almost certain to be a considerable loss.

Then, again, with a condenser belted or otherwise operated from the engine, the economy of the condenser is that of the engine with a consumption of less than 20 pounds of steam per horse-power per hour: and the range of conditions over which the condenser is valuable is much greater than in the case of the independent direct-acting pump taking steam full stroke with a water rate of probably 200, or more than ten times as great as in the former case.

In general, it may be stated, that only under the exceptionally favorable conditions of a properly proportioned condenser of an economical type (an engine not too large for the work, and a load variable to but a slight degree) is a condenser at all advisable. So seldom are these conditions realized in practice, that probably not one plant in five could be run with this extra mechanism at a profit over and above what could be obtained without it and with a good form of feed-water heater. Repeated expert tests have shown this to be true, and a better proof is the general acceptance of the fact by those most interested—the manufacturers.

In the few cases where it is undoubtedly commercially valuable, the structural disadvantages of the independent condenser has been against it as much as the inefficiency of the independent system.

Recently, a combination which incorporates the advantages of both, has been designed. It consists of a Dow positive rotary pump, coupled direct to a small Westinghouse engine, as illustrated in the accompanying cut (on this page) and is briefly a high-speed independent condenser with all the economy of operation found in the belted form. With the results indicated by a practical test of this form of condenser in the New England States during the past year, many of the objections to such a plant are removed and the possibility of economy extended over a greater range of unfavorable conditions.

Ample restaurant accommodations are to be provided at the Exposition grounds. The locations for restaurants thus far decided upon are four in the Mines and Mining Building, sixteen in the Manufactures Building, and six on the esplanade in front, four in the Electricity Building and two in the Woman's Building. Some are on the ground floor and some in the galleries.

A COAL-SAVING LOCOMOTIVE.

A little saving in fuel on a locomotive goes a long way sometimes.

"The single item of coal, in the operating expenses of a railroad," says Superintendent Filmore, of the Southern Pacific R. R., "is one of the most important in affecting the profit and loss account and for that reason every device which reduces the consumption of coal while maintaining the efficiency of service is at once adopted.

"There is the latest invention," he continued, tossing over a photograph of a coal-saving locomotive placed in use on the line between San Francisco and Sacramento on Sunday last. "The new engine is built to use both high and low pressure consentaneously. It is a ten-wheel passenger engine, using bituminous coal. The driving wheels are 69 inches in diameter and the driving-wheel base is 12 feet 2 inches. The weight on the drivers is 99,800 pounds, on the truck 30,800 pounds, a total of 130,800 pounds, or a little over 65 tons. That weight is exceeded by many of the engines now in use on the company's lines, but it is believed that by using the new device the lighter machines will do quite as much duty as the old ones, and at a saving of wear and tear both of roadway and engine.

"The new model appeals to the trained eyes of railroad men as being a workman-like looking construction, but the average man will miss the handsome outlines of the older models, with high, roomy cabs, quaintly devised sand-tanks and gracefully swelling smokestacks. The merit of the new engine however, lies in the fact that it saves two-sevenths of the coal necessary to run the ordinary engine.

"The run from San Francisco to Sacramento is eighty-nine miles and the old passenger engines in use burn three ane one-half tons of coal in making the round trip. The new machine burns but two and one-half tons of coal in covering the distance in the same time. The saving is effected in this way. The old engines run under high pressure and after the steam has been utilized in the cylinders it escapes into the air under a great pressure and consequent high figure of energy. In the new engine one of the cylinders is of the ordinary size and to that cylinder steam is admitted direct from the boiler at a great pressure. Instead of passing from the cylinder into the exhaust the steam from the first cylinder passes through a pipe over into the cylinder on the other side of the locomotive. That cylinder is much larger in proportion of surface of piston-head as 1 to 2. The steam entering the larger cylinder at the lower pressure does precisely as much work as it did when first conveyed from the boiler. The coal necessary to keep up a gauge pressure sufficient to drive one piston rod now suffices for both driving rods. The principle has not been worked out to an ultimate, but has so impressed the railway people as to induce the present successful trial of the invention.

"To estimate the value of the saving a few figures may be helpful. The ordinary life of a locomotive engine is twelve years, and its cost from $10,000 to $12,000. The saving in coal under the new system, in twelve years, would amount to $12,960, an amount more than sufficient to replace the wornout locomotive with a new one."

In the interest of the Persian participation in the Exposition, the Persian government has lifted the export duty on all goods which will be sent to the World's Fair from Persia, and it has also lifted the import duty on all goods which will be purchased at the World's Fair and brought into Persia. These concessions have greatly increased the interest taken in the World's Fair in Persia.

The American Street Railway Association has applied for 50,000 square feet in the Transportation building, of the Columbian Exposition, and appointed a committee to help Chief Smith get a suitable exhibit, which will be collective. The committee comprises men interested in street railways from New York to San Francisco and from Montreal to St. Louis. John B. Parsons is the Chicago member.

CARE OF BOILERS.

By Edwin Woodward.*

The endless uses to which the steam engine is now put makes it a machine of incalculable worth, and while its worth when used with ordinary care is so great, the evils and disasters arising from the careless or more often ignorant engineer, makes it sometimes seem a questionable blessing. With every new industry requiring power, it is the ultimate duty of the engine to furnish it, and at every change of method such as we are daily, or at most yearly, meeting with, we see some new application of steam power.

This is especially true now, in the agricultural sections of the country, where the saw-mill, having done its work, is replaced by the steam threshing engine, which also drives the lath and picket mill. The small semi-portable is now very available to drive the tubular well, run feed-mills, churns, chopping machines, pump water, and a thousand other duties constantly rising before the face of the agriculturist. What is more, their use is imperative, and not of volition. Need being the incentive, the engine is bought with the comforting assurance that "It will almost take care of itself. Keep plenty of water in the boiler and fire enough to keep the steam up, plenty of oil, and that is all there is of it."

A boy is given charge of it. The boiler, being new and tough, stands the abuse well, and before many weeks the boy "knows how to run an engine as well as any one," and with this extensive practice and uniform success to recommend him, gets a more responsible position, with a steam plant, perhaps not so new, but his past luck, in the minds of the owners, insures safety; and with no new recklessness—only too much fire, too little water—an explosion is the usual result.

The loss of property is of little importance compared with the loss of life or the maiming of the innocent victims of—what? Ignorance, criminal neglect on the part of the Legislature in not giving us a law requiring evidence of the ability of the man in charge, or rapacity of the manufacturer? Let the guilty ones answer.

A person who is to take charge of a boiler should make himself familiar with all the needs or defects of it. In the first place its strength should be known, and this is best fonnd by a force pump, warm water—cold water pressure is injurious—and a test gauge, or a steam gauge known to be correct, and the test made at least 20 per cent. greater than the maximum steam pressure to be used. Knowing the boiler to be strong enough, the next step is to examine the pump, which should be in perfect working order. Having absolute evidence that the pump can supply, the business of supplying is a mere matter of routine, but a pump that will sometimes work and sometimes will not, is eligible for the most rigid and instantaneous examination. It may fail when its work is most important. Granted motion to the piston or plunger, a pump fails because it leaks. There can be no other reason, and the leak should be found and repaired. Leaky valves are common and should be ground. Leaky pistons are not so common, but sometimes occur. Repairing is the remedy. Leaky plungers are common. They need returning. The rod must be straight as far as in contact with the packing. The packing around the plungers is sometimes neglected too long, gets filled with dirt and sediment, and hardens and scores an otherwise perfect rod, and so leak.

The stuffing-box should have a generous allowance of hemp-not drawn tightly around the rod, but the box well filled, and the gland screwed down tight enough to prevent a leak. Too tight only ruins the elasticity of the packing, and causes undue friction. It is usually the source of exasperating leaks. It is usually made up of poor-fitted nipples, elbows, couplings, and to complete the train of evils, a globe valve without any gland, and poorly packed. Freezing weather often opens the weld at the top of the water, or in some water-pocket not properly drained. Any of these causes will destroy the efficiency of a pump, and are so known to exist—effectiveness is wanting. A leak on the delivery side of a pump is invariably visible, the water spurting at every stroke.

Leaks affect injectors the same as pumps, and in addition, the accumulation of lime and other mineral deposits in the jets stop the free flow of water. The heat of the steam is usually the cause of the deposits, and where this is excessive it would be well to discard the injector and feed with the pump. In many small industries it is impracticable to use a feed-water heater and purifier, but when this is not so it will be found a great aid, for one of the most important cares of an engineer is to keep the boiler clean. No scale should be permitted to collect. Mud should be allowed no place in a boiler. The writer has seen the sheets in the water leg of a locomotive type of a boiler sprung half an inch between stay bolts six inches apart, from accumulation of scale lodging and burning fast there.

There are many compounds in the market that are recommended for dissolving scale. They should be used with care. Some are strong enough to "dissolve the boiler."

Of the many other duties relative to the care of boilers, some further reference will be made in subsequent papers, the aim being to furnish the novice with the necessary information to prevent his too ready acquaintance with the Great Mystery.

*In *Scientific Machinist.*

THE NERACHER AUTOMATIC FIRE SPRINKLER.

We note with pleasure that quite a number of large woodworking firms, among hosts of other manufacturing concerns and large business houses, have contracted with the Neracher Sprinkler Company for the equipment of their properities with automatic sprinklers. The day was when it was generally doubted that any device could be so constructed and arranged within buildings as to make successful use of fire as an agent against its own destructive force. The extinguishment of over 2,000 fires in the last ten years, and the action being taken by the managers of some of the larger insurance companies to secure and retain upon their books risks standardly equipped with automatic sprinkler has awakend fresh interest in the minds of leading manufacturers and business men in the country to the question of protection against fire. In some localities it would be needless to furnish any information as to their workings, but in other localities the lack of information is something to be wondered at. We presume this can be partly accounted for from the fact that local insurance agents are interested, as a rule, in preventing a widespread knowledge of their use and efficiency. To them automatic sprinklers means reduced premiums and loss of commissions, and their interests are best conserved in high rates and ingnorance on the part of the insuring public. For the benefit of such of our readers as may never have seen an automatic sprinkler and do not understand its workings, we illustrate one that is rapidly taking the lead of its competitors in the East as well as in the West.

While other sprinklers have failed when placed in contact with corrosive vapor and dust accumulations, the Neracher sprinkler is so constructed as to render it safe and certain of working with all the causes against it that have forced other sprinklers out of the market after a brief patronage. It was invented and placed upon the market in 1882, and has, therefore, been in use long enough to have had its defects discovered if it had them, but it has grown in favor as its age increased. In addition to its being proof against corrosive acids and dust accumulations, it combines strength and sensitiveness not shown in any of its competitors, and is, therefore, less liable to leakage from water hammer or high pressure of water in the pipes. The Neracher Company, and their agents, express willingness to place their sprinklers under 2000 pound pressure, and claims for it much quicker action under the same degree of heat than can be found in any other sprinkler. These are important features as minutes and even seconds count for money in the extinguishment of fires, as does also its strength where thousands of dollars of water damage may be experienced in a short time by the breaking of a sprinkler.

In Fig. 1 is shown this sprinkler as it stands uprightly in pipes suspended from the ceiling or the joists of the floor. It differs from all others in use in a method by which the valve is held to its seat by means of several parts forming a pair of toggle arms; the valve is thus held to its seat by means of a relatively slight stress exterted by the link. In the act of opening none of the moving parts slide upon each other, and they are therefore not susceptible to interference by exposure or corrosion.

Fig. 2 shows the sprinkler as it stands after heat—150 degrees Fahrenheit—has caused the link holding the toggle arms together at the top to separate, thus releasing the valve from the mouth of the sprinkler and permitting the water to strike the ragged convexed shaped deflector above and thrown upwardly and outwardly over the fire in a shower. Links made to fuse at different degrees of heat are provided so that if a 150 degree link is too sensitive, as in dry links, over boilers or adjacent to steam pipes, a harder link is substituted. To prevent unnecessary water damage, alarm gongs and electric batteries are furnished with every equipment, and the breaking of a single sprinkler instantly sounds the alarm and gives notice to the watchman that a fire is in progress or has been started in the building. It is claimed that watchman seldom see the fire, as it has been extinguished before he finds it, and his duty consists in breaking the seal, closing the valve and replacing the broken sprinkler with a new one and again turning on the water.

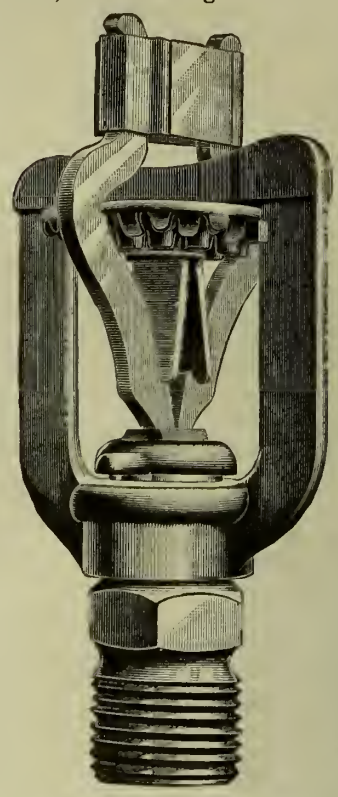


Fig. 1.—Sprinkler Closed.

In buildings not artificially heated so as to prevent freezing of water in the pipes what are known as dry systems are provided, which means that instead of the pipes being filled with water they are thoroughly drained of water and air forced into the pipes by compressed pumps. At the base of the riser pipes, or at the point where the main supply pipe enters the building, an automatic air valve is placed in position. This valve is so constructed that from ten to fifteen pounds of air in the pipes is sufficient to hold back any number of pounds water pressure. The moment a sprinkler breaks the reduction of air pressure occuring in the pipes releases the air valve from its seat and water enters in less time than is required to read the mentioning of it. So important has this branch of the insurance business become that syndicates of leading companies have been formed and expert sprinkler and pipe men employed so look after sprinkled risk. Scales have been adopted so as to properly proportion the sizes of pipes to the number of sprinklers to be supplied. Methods of hanging, drainage and styles of fittings and valves used are closely looked after, and every precaution taken to pre-

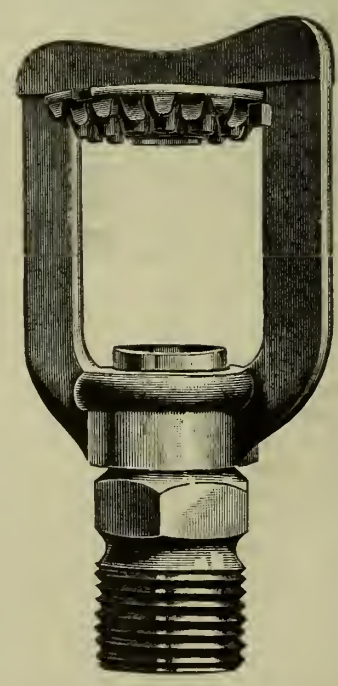
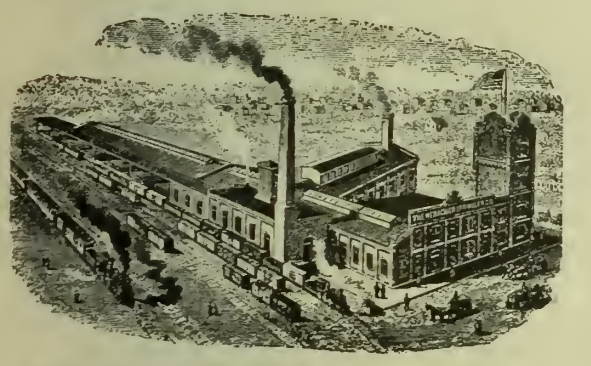


Fig. 2.—Sprinkler Open.

vent accident to the equiment and property through closing of valve or other causes.

To prevent the reputation of their sprinkler being damaged by inexperienced workmen or those not familiar with requirements of insurance companies, the Neracher Sprinkler Company refuse to place their sprinkler in the hands of local dealers or pipe fitting firms, but send their own men to plan and execute the work, guaranteeing its acceptance by insurance companies. Their works, at Warren, O., —a view of which is given herewith—are the largest and best of the kind in the country, and they are constantly adding new and expensive machinery to keep up with their rush of orders.

To show why syndicates are forming among insurance companies to secure the class of risks equipped with automatic sprinklers, we quote from a report made last March by a New York company making a specialty of insuring property only that is equipped with standard sprinklers. They report a loss of 3¼ per cent. of their premium receipts, while the ninety odd companies doing a business in that State, as shown by the Insurance Commissioner's report, was 66⅔ per cent. If automatic sprinklers can continue to even approximate four times the amount of this showing, and general business men give them the patronage that is their due, is it not reasonable to suppose that the end of high rates of insurance and an annual loss of from one



Works of the Neracher Sprinkler Company.

hundred to one hundred and twenty millions of dollars is not in the far future? It means, too, that the whole method of transacting the insurance business of the country must be changed from a commission to a salary basis and the incompetent and dishonest agent becomes a thing of the past.—*St. Louis Lumberman.*

Further information (circulars, etc.) may be obtained from the home office—at Warren, O.; also from A. F. Carpenter, General Southwestern Agent, room 13, Laclede building, St. Louis, Mo., or from H. W. Bracket, Mallers building, Chicago.

LARGEST TUG IN THE COUNTRY.

The tug Fearless, the property of John D. Spreckels & Bros., which was launched at the Union iron works, San Francisco, recently, measures 153 feet over all, 145 feet between perpendiculars, twenty-six feet beam and sixteen feet depth of hold. Steel is used in the construction throughout, and the houses and cabins are finished in the costliest of hard woods. The registered tonnage is 365. All that remains to complete the largest tugboat in the Union is to put in the engines, which have also been constructed at the Union works. These engines are triple expansion, with a thirty-six-inch stroke. There are two cylindrical boilers, with a steam pressure of 165 pounds. The capacity of the engines is over 1,000 horse-power, and will develop a speed of between fifteen and sixteen knots an hour. The rails and decks are also of steel, the latter covered by teak. An innovation in tugboats is the owner's cabin, and it is a gem of the builder's art. The Fearless will be ready for service about the first of the year. When completed she will have cost $175,000. She will carry a special fire pump in addition to the latest and best marine fire apparatus. She will have in her bow what is known as a monitor nozzle, which can be pointed in any direction. In the event of a fire in a ship the Fearless will be able to approach her, bow on and let the monitor pour in a stream of water of great size. The Fearless is also fitted with one of the finest of search lights, equal in power to those of the cruiser San Francisco.

LOCALIZATION AND REMEDY OF TROUBLES IN DYNAMOS AND MOTORS.—VIII.

By Prof. Francis B. Crocker and Dr. S. S. Wheeler.

Continued from Page 197.

VIII.—DYNAMO FAILS TO GENERATE.

This class of troubles is, of course, confined to dynamos and corresponds somewhat to the previous class for motors. This trouble is almost always caused by the inability of the machine to sufficiently "excite" or "build up" its own field magnetism. The starting of a dynamo requires a certain amount of residual magnetism, which must be increased to full strength by the current generated in the machine itself.

1st Cause.—*Reversed residual magnetism,* due to (*a*) reversed current through field coils, (*b*) reversed connections, (*c*) earth's magnetism, (*d*) proximity of another dynamo, (*e*) brushes not in an effective position.

Symptom.—Little or no magnetic attraction when pole-pieces are tested with piece of iron.

Magnetism weaker when machine is running and field circuit is closed than when machine is stopped or field open, because current generated tends to build *down,* as it were, or neutralize the magnetism.

REMEDY.—Send a magnetizing current from another machine or battery through field coils, then start and try machine; if this fails, apply the current in the opposite direction and try machine again.

Reverse field and armature with respect to each other, *i. e.,* reverse connections of either one or shift brushes.

2nd Cause.—*Too weak residual magnetism.* Symptoms and remedies of this trouble are substantially the same as in the previous case, but the attraction for a piece of iron is even weaker—in fact, practically nothing.

3rd Cause.—*Short circuit in the machine or external circuit.*

This applies to a shunt-wound machine, and has the effect of preventing the voltage and the field magnetism from binding up.

Symptom.—Magnetism weak, but still quite perceptible.

REMEDY.—If short circuit is in the external circuit the opening of the latter will allow the dynamo to build up and generate full voltage. If the short circuit is within the machine, it should be found by careful inspection or testing. In either of these cases do not connect the external circuit till short circuit is found and corrected.

A slight short circuit, such as that caused by a defective lamp socket or copper dust on the commutator, may prevent magnetism from building up.

4th Cause.—*Field coils opposed to each other.*

Symptom.—If pole-pieces are approached with a compass or other freely suspended magnet, they both attract the same end of the magnet, showing them both to be of the same, instead of opposite polarity.

For similar reasons the pole-pieces are quite strongly magnetic when tested separately with a piece of iron, but show less attraction when the same piece of iron is applied to both pole-pieces at once, whereas the attraction should be much stronger. In multipolar machines these tests should be applied to consecutive pole-pieces.

REMEDY.—Reverse the connections of one of the coils, so that the polarity of the polo-pieces is opposite and not the same.

5th Cause.—*Open circuit.*

(*a*) Broken wire or faulty connection in machine, (*b*) brushes not in contact with commutator, (*c* safety fuse melted or absent, (*d*) switch open, (*e*) external circuit open.

Symptom.—If the trouble is merely due to the switch or external circuit being open, the magnetism will be at full strength, and the machine itself may be working perfectly, but if the trouble is in the machine, the field magnetism will probably be very weak.

REMEDY.—Make very careful examination for opening in circuit; if not found, test separately the field coils, armature, etc., for continuity with magneto or cell of battery and electric bell. (See Instructions for Testing.)

Conclusion.

It is obviously difficult, if not impossible, in the treatment of dynamo and motor troubles to give complete directions for locating or identifying all the various troubles, but in most of the cases this will be found possible; and moreover it is a fact that a mere list of these troubles, particularly if it is systematically arranged, is of the greatest help in overcoming these difficulties. It is in the promptness and intelligence with which such troubles are dealt with that the ability or inability of a man is most clearly shown.

THE STANLEY BOILER.

A new type boiler has been designed by Mr. H. B. Buckland, C. E. of Baltic Chambers, Newcastle-on-Tyne, (Eng.) who has had considerable experience in boiler construction, and has long been impressed with the excessive weight of, and space occupied by, ordinary marine and land boilers. The idea occurred to him to make boilers spherical instead of cylindrical, and the outcome was the Stanley boiler. Mr. Buckland holds this boiler can be utilished for both land and marine purposes, and put to almost any pressure without using the very heavy plates that are necessary for a cylindrical boiler. The Stanley is comprised of two separate parts, a furnace and a boiler. The furnace is a cylindrical water chamber, with one or more fire doors, and into which all the feed water passes from the pump, and is fitted with a grate. The boiler is a spherical shell truncated at the bottom, with a plate riveted in convexly. This plate forms the bottom of the boiler and the top of the furnace, though not attached to the latter in any way. To this plate can be attached one or more combustion chambers, according to the size of the boiler. These chambers are made partly spherical, and concentric with the shell, and are open to the flames at the bottom, and connected to the shell by means of a number of smoke tubes connecting the bottom plates and the shell there is a number of large diameter tubes. The shell of the boiler is encircled by a smoke-box which can be made either entirely circumferential or separate boxes and uptakes to each combustion chamber. In this case the upper portion above the centre line is made continuous, a diaphragm dividing it from the lower boxes, which are made one to each combustion chamber. The space between the boxes is left open to the shell to get the various fittings attached to the boiler, and from any part of the upper box the uptake leads the smoke to the funnel.

By this arrangement the flame and gases are broken up on leaving the fire and those from the outside diameter pass through the large tubes into the lower smoke-boxes, return through the small tubes into the combustion chambers, commingle with the flames and gases arising direct into the combustion chambers, thus increasing the combustion, and out through the tops rows of tubes into the upper smoke-box and round to the funnel But to increase the combustion of gases and smoke Mr. Buckland has attached branches into three of the lower tubes in each nest, bringing the ends through the bottom of the smoke-box and fitted them with a shutter-valve, so as to admit warmed air into the chambers in between the two flows of gases. It is stated that this method with one of the most smoky coals has kept the discharge of smoke from the funnel very light coloured. The shell is fitted with a dome to increase the necessarily small steam space. The boiler is attached to the furnace by means of angle and plate brackets, by which means the boiler can be supported, and the furnace withdrawn for repairs. They are otherwise connected by the feed pipes, as all water goes into the furnace first, and is heated up to about boiling point before it passes through these pipes into the boiler proper, therefore nearly all the worst strains that take place in a boiler will do so in the furnace, which can easily and cheaply be renewed, and the boiler should thus have a prolonged life.

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CONTENTS OF THIS NUMBER.

FREE packing, that is a recipe for "a cheap and very durable packing," is given free by Mr. L. I. Hall, in our Correspondence columns this week. For our next number we are promised the description of a new tool (on which there is no patent) for holding the crank end of a line when lining up an engine. It is the invention of a well-known and highly respected Supreme Council official of the A. O. of S. E. The description will be given (free) so that every one who wishes to do so may make this useful tool for himself.

MINCE pies are made in different ways. Those who have tried the way detailed in our Women's Department this week say that this plan beats any other a long way. "The head of the household" who furnishes these useful instructions is as well posted concerning the peculiarities of boiling water as the most intelligent engineer concerning steam, and also knows the law governing time and quantities (compounding mince pie ingredients) as thoroughly as the steel maker knows (from the color of the fluid) when to pour out the hot metal. There is also a best way to make even the crust for a mince pie.

PORTLAND, Ore., has a healthy atmosphere, it seems. At all events, the engineers are clear-headed and intelligent, as set forth by "One of the Boys" in our Correspondence department this week; and Multnomah Council is one of the most promising in the A. O. of S. E. Although Oregon is a young State, and Portland but a very modern city, the engineers are no novices, but men of great experience, with heads screwed on right and full of knowledge and common sense.

ELECTRICAL engineers have taken great interest in the series of articles which we have had the privilege of publishing, by Prof. Crocker and Dr. Wheeler, of the Crocker-Wheeler Electric Motor Co. They know whereof they speak when they treat of dynamos and motors. These articles, entitled "Localization and Remedy of Troubles in Dynamos and Motors," the last of which appears in this issue, were first published in the *Electrical Engineer* (of New York), and they have appeared in no other paper except THE AMERICAN ENGINEER, as far as we know. They are copyrighted, and cannot be reproduced without the consent of the authors.

WEIGHT OF WATER.

In this issue we have the pleasure of presenting a table, prepared by Mr. Jeremiah Leahey, Jr., showing the weight of a gallon of distilled water, at various temperatures. In our issue for August 15 last we published a similar table, by the same author, showing the weight of a gallon of spring water (filtered). Mr. Leahey has obtained copyrights thereon as author.

As may be observed, there are three kinds of gallons—the United States, the New York, and the Imperial. Distilled water (as might be expected) is lighter than filtered spring water. And all water becomes lighter the hotter it is.

ORDER OF AMERICAN STEAM ENGINEERS.

A local paper says: The fraternal engineers of Multnomah council, No. 1, A. O. S. E., will give an open meeting next Wednesday evening at their hall, corner Second and Yamhill streets. This mechanical order, which consists only of the engineers, electricians and builders of power plants, will make it a special feature of the evening to invite the architects of the city and all those who are contemplating putting in steam power or electric plants or pumping machinery, as there will be several subjects brought before the council for open discussion of a very interesting nature, which will be highly entertaining to those of a mechanical mind. Seats free. Everybody invited, and especially those dealing in machinery supplies.

This fraternal council may be considered one of those orders of an honored merit. It takes care of the dead, cares for the widows and orphans of deceased brothers and cares for the sick, and, above all, is bitterly down on strikes or anything that will depreciate the business of its employers—purely an American institution.

A DAMAGED ENGINEER.

The Illinois Central Railroad Company is being sued in the Circuit Court, Chicago, for $75,000 damages by Edward E. Barker, who has been an engineer for the company for twenty-five years. Nov. 22, 1890, he had his collar bone broken, his right arm disabled, and his left leg taken off in a collision near Kankakee. The accident is said to have been caused by a defective and misplaced switch. Mr. Barker is a man of family. We hope he will get a substantial compensation.

DANCING ENGINEERS.

On Thanksgiving eve (Nov. 25) the 10th annual ball of the Chicago Association of Stationary Engineers, No. 1 of Illinois, was held at the Second Regiment Armory. There was excellent music, enjoyed by a large attendance. The dancing was tip-top, all enjoyed themselves, and a handsome sum was realized.

W. A. Alexander and Louis Gelder, representing the insurance associations of Chicago have asked for space 50x100 feet, to construct a building at the World's Fair to constitute an exhibit of the most improved methods of fireproof construction and the appliances used in saving goods from burning buildings. The building, it is urged, can be occupied by a salvage corps during the Fair.

PERILS OF LOCOMOTIVE ENGINEERS.

Thomas W. Major was pinned down to his engine for thirteen hours with only his head above water. According to the *Seattle Post-Intelligencer*, a special coal train on the Columbia and Puget Sound railroad, coming from Cedar Mountain at 1 o'clock in the morning, was thrown from the track by a cow near Elliott and the engine and eight cars were dumped into Cedar River. Thomas W. Major, the engineer, stuck to his post and was carried down with the wreck into the water. The river is a cold mountain stream, and it was swelled considerably by recent rains. The cab had turned over on its side, and Major's feet had become wedged into the iron work around the throttle, and he was almost submerged into the cold water. To add to his awful situation the steam from some broken pipe was escaping and threatened to scald the unfortunate man. All the lights had gone out in the crash, and it was at first difficult to get at the engineer. Finally one of the men found a scoop shovel and got down and held it in front of Major's face to shield him from the scalding steam. Another found a way in, and by standing in the water he was able to hold the engineer's head out of water and bathed the already scalded face. It was found impossible to pull him out. By reaching down in the water the fireman succeeded in getting at the valve which allowed the steam to be blown off, and that danger was averted. One of the brakemen ran up the track to Denton, three miles away, and telegraphed the fact of the wreck to Seattle. A wrecking-train was immediately made up and arrived at the scene at 4:30 o'clock. Major had been in the water for nearly four hours and there was still no way to get him out. He was in such terrible pains at times that he would beg his companions to put an end to his suffering by killing him. They gave him every stimulant that could be had, but he frequently became unconscious. It was impossible to lift the engine and the wrecking crew put in its energies upon breaking the throttle lever and the circular piece of steel that held the engineer's feet. Long cold-chisels were brought, and while one man would hold the end of one under water, the other would strike. The chisel would rebound, and it would require a long time to find the same place again. It was only after thirteen hours of incessant work that the engineer was liberated from his terrible position. He was placed on cushions and brought to Seattle immediately. An examination disclosed that the left leg was broken half way between the knee and the foot, and both ankles were frighfully bruised. It is thought that he will recover.

A telegram from Jacksonville, Ill., Nov. 22, says: The Jacksonville Southeastern suffered another wreck at this point at 4 o'clock this morning, resulting in the loss of one life and damage to a vast amount of property. A. W. Beck was to relieve the engineer bringing in the Red Express from Chicago bound for St. Louis. He had to go north of the city a mile for water, and, being late, he rushed into the train dispatcher's office and asked where the Red Express was. The operator in charge replied fourteen minutes late out of Havana, forty miles distant. Instead of losing time, however, Charles Hairgrove, the engineer of the Red Express, had made up the time, and, owing to the bad condition of the weather, neither engineer could see the near approach of the other. Just before the tank was reached, and when both machines were under full headway, they came together. Beck and his fireman jumped after first having reversed the engine, and escaped injury. Hairgrove saw the danger and reversed and applied the brakes. In this, however, he sacrificed his own life, as he had not time to jump and was crushed between the engine and tender. He died at 9 o'clock. His fireman escaped injury by jumping. Both engines were badly wrecked. Two or three cars were derailed, and for six or seven hours the track was blockaded.

A correspondent writes as follows: Charles Hairgrove, the engineer who so bravely sacrificed his own life to save the passengers on his train on the Jacksonville and Southeastern railroad Sunday, was known to many of the engineers who run into Chicago over the Santa Fe road. Engineer Dawson of No. 486 was seen at the roundhouse on Monday and he said: "I have frequently met Hairgrove at

Eureka. He was a quiet-looking fellow of medium height. We had not much time for talking because he used to take away the train that I would bring down. His run was from Eureka to Jacksonville, and while I would be at Eureka he would be on the way to Jacksonville. On the other hand I would be here or on the way here while he was resting at Eureka. Beck, who is said to be responsible for the unfortunate affair, took the train from Hairgrove at Jacksonville and ran it to St. Louis." Mr. Dawson said he used to hear the men who met Hairgrove always speak well of him. None of the men could tell whether the engineer has left a family. He could have saved his life, it is claimed, by following the example of his fireman and jumping from the engine when he saw that a collison was inevitable.

A report from Syracuse, N. Y., Nov. 22, says: The express and mail train which left here to-night ran into a freight train one mile east of Canostata. The smash-up blocked all but track No. 4, and the wreck took fire, burning several expresses and freight cars. Engineer Thomas Park of this city and Fireman Edward Baird were seriously but not fatally injured.

SHE SATISFIED THE SOUND PEOPLE.

The new steamer Flyer arrived in Seattle on Saturday about 1 o'clock and was given an ovation. As she entered the harbor her deep whistle was responded to by every boat and mill whistle in the bay. The crowds cheered and cheered, and the confusion of sounds was almost deafening. She glided by her wharf, which was covered with people, and rounded the harbor amid the wildest enthusiasm. Her officers are delighted with the record she made in coming around, both as to time and sea-worthiness. She made the run from the Columbia river to Cape Flattery in eight hours and fifty-two minutes and from Port Townsend to Seattle in two hours and eighteen minutes. This was no test of speed, for the boat was not in trim for even giving a fair trial of her speed. Her machinery has worked as smooth as a clock, and every bearing runs as cool as though she had been running for months. Engineer Devlin is greatly pleased with the working of her machinery. He says that she uses about one cord of wood per hour. Captain Graves declares that she is the best sea boat he was ever in in his life.

"THE collection and disposal of sewage and the pollution of rivers" was the subject of Mr. John T. Wood's inaugural address on taking the chair of president of the Liverpool Engineering Society rerecently. He stated that the question of sewage disposal broadly lay between irrigation and precipitation with filtration, and the first essential condition of a perfect system of sewerage for any center of population was that the sewage should be collected in practically water-tight sewers and drains so designed as to size and gradients that, being self-cleansing, they would admit of its speedy removal to some convenient place for treatment. He then proceeded to point out the difficulties that lay in the path of the sanitary engineer, who had advised the treatment of a certain sewage by broad irrigation, not the least of which, he said, was the difficulty of obtaining a sufficiently large area of land of suitable quality in such a position and of such a price that the local authority would be justified in acquiring it.

Mr. Woods concluded his address by making some remarks upon electrical processes of purification, says our correspondent.

WHO WILL BE THE WINNERS?

THE AMERICAN ENGINEER Publishing Co., with the view of bringing up the circulation of the paper to fully 20,000 copies each issue, offer a premium of $40 to the one who will send in the greatest number of new subscriptions, $20 to the one who will send the second greatest number, and $10 to the one who sends the third greatest number of new subscriptions, by January 1, 1892.

Montana's World's Fair Commission has set aside $5,000 of the State's appropriation of $50,000 for the use of the women.

ELECTRICAL HORSE-POWER.

The horse-power of a dynamo is expressed by what used to be known as volt amperes, divided by the constant 746, that is to say, the energy represented by a volt, multiplied by an ampere, is one 746th of a horse-power. This constant is got from the fact that experiments on the decomposition of water, etc., have proved that the horse-power expended in sending a current through any resistance is 1-746 part of the current in amperes multiplied by the electromotive force in volts impelling that current. To find the horse-power of a dynamo it is only necessary to multiply the nnmber of amperes by the volts, and divide by 746. Thus a given dynamo produces, say, 200 amperes at a pressure of 350 volts, then $\frac{200\times350}{746}=93.8$ h.p. It matters not at all what ratio exists between the volts and the amperes. We may augment one and increase the other as we please. Thus, for example, we might have a single ampere and 70,000 volts, or 70,000 amperes and one volt. The expenditure of energy would still be the same, viz., 93.8 h.p. When an engineer sells an engine to drive a dynamo, he can always ascertain the power exerted by his engine by means of the indicator. The electrician can always supply the figures relating to quantity and pressure, namely, the number of volts and amperes, and thus all the data needed are available for calculating the combined efficiency of the engine and dynamos, and the respective efficiency of each, provided that a trustworthy friction diagram of the engine can be had. The facts are so well known that we should not give them here, were it not that it is desirable to state them, in order that what follows may be readily understood by engineers who have only a general knowledge of electrical laws and phenomena.

The rules we have given for calculating electrical horse-power are only applicable to continuous current machines. That is to say, dynamos which discharge practically continuous currents of electricity in one direction. In the alternating dynamo the currents flow alternately in opposite directions; the number of alternations being exceedingly rapid, as much, for example, as 1,000 in a second. It was at first believed that it would be possible to calculate horse-power in the case of alternating machines just as easily as if the currents were continuous.

Practice has, however, shown that this view is quite untenable; and the facts have furnished matter for much speculation among electricians. Briefly stated they are as follows:--An alternating dynamo sends a high pressure current, say 6,000 volts, through a cable and transformers. The transformers, however, do no work, no lights being on their circuit. The amperes are, say, 9. Then $\frac{9\times6,000}{746}=72$ h.p., and the engine ought to indicate about 90 h.p. But strangely enough, it will do nothing of the kind. It will indicate instead only about 17 h. p., or less. In a word, although there are apparently 72 electrical horse-power being generated, the engine will only give a friction diagram. If now lamps are put on by degrees, there will be no difference in the volts and amperes, but the horse-power of the engine will augment until at last a point is reached when the hand of the ampere meter begins to move. The addition of a single ampere will then suffice to render the expenditure of 100 indicated horse-power necessary. Thus, then, it will be seen that the apparent efficiency of an electric lighting plant might be enormous, as much as three or four hundred per cent., while in reality it was very moderate. It is well that this truth should be carefully borne in mind whenever any statement of the efficiency of a given dynamo is put forward. But after every allowance has been made in this way, it still remains to be settled what the horse-power of the dynamo actually is. Thus, in the case we have mentioned, the machine requires no power to drive it up to 9 amperes output save that needed to overcome its friction, but at 10 amperes we find the engine indicating, say, 100 h. p. What, under the circumstances, is the real output in energy of the dynamo? So far as is known at present there is no means in existence for ascertaining the facts directly, they can only be got indirectly from the work done by the transformers.

Our engineer readers may not unnaturally ask us to explain the cause of the phenomena in question. We regret that we are quite unable to do this. Four or five theories have been advanced by as many electricians of eminence, but they are as yet unable to agree. The facts are very curious and complicated, and any statement of the theories advanced would be unintelligible to non-electricians. It must suffice to say that a great deal depends on the cable. Every conductor requires a certain quantity of electricity to charge it, just as, for example, a gas main must be filled with gas before it can begin to supply lamps. According to one view, a cable working on a continuous current is charged, to begin with, by the first revolutions of the dynamo. A cable on an alternating current is, on the contrary, charged and discharged at every alternation; and this charging, although registered by the volt and ampere meter, does not represent any great expenditure of energy. The dynamo is, in a sense, working under the conditions as a pump on a closed circuit.

A pressure gauge on a main might show 200 lbs. pressure within it, while a meter showed a discharge of 1,000 gallons a minute, and yet the work done might be very small. This is a very crude illustration of what is supposed to take place, but it will serve to consolidate ideas, and we cannot hope to do more. The size of the cable, its length, the number of cables, and very many other details of construction, modify the results. It is more than probable, however, that before long a theory which will cover and explain all that is now puzzling will be propounded. Until this desirable end has been reached, it seems to be practically impossible to say what the true efficiency of an alternating plant may be, and how it compares with that of a continuous current plant; and it is more than probable that some new system of constructing ampere meters must be devised. As matters stand, an engineer in charge of an electric lighting station may be misled concerning the work which his engine is doing.

It is probable that in large installations, where there is an abundance of electrical talent available, no trouble is likely to arise in this way; but it is quite possible, on the other hand, that mistakes may be made when the plant is of comparatively small dimensions, and intending purchasers of alternating machines will do well, with the facts we have stated before them, to receive with caution all statements of exceptionally high efficiencies obtained when there are great lengths of cable in circuit. Finally, we would add that what we have written is not intended to be of any service to electricians, who are, or ought to be, to a large extent aware of the facts; but, as we have already stated, for the information of engineers possessing no acquaintance with the more recondite aspects of electrical phenomena.--*Engineer*, London.

A NEW ELECTRIC RAILWAY POLE.

Manager A. G. Davis, of the Canton (O.) Street Railway Co., has completed a model of an iron post for electric wires, upon which a patent is pending. The parts have been given a practical test at the works of the Wrought Iron Bridge Co., the test proving highly successful, as they did not show any signs of springing under a strain of 2,962 pounds. The demand for these posts will be quite large it is expected, as they are less objectionable than clumsy wooden ones, and very much better than any iron poles hitherto used. The Wrought Iron Bridge Co. will manufacture them.

It will in all probability make a small fortune for the inventor, says the *News-Democrat*. The same paper says, it is the lightest and strongest pole made and the metal is distributed in such a manner as to give the best results. It is impossible to spring it out of line. If properly painted one of the iron poles will last forever. Mr. Davis is a genius as an inventor and is probably the best posted man in Ohio, in electric street railway business. He is very modest in talking about his new invention, but those who are posted say the pole will be a big success.

The Illinois Board of World's Fair Commissioners has ordered specifications for the architectural reproduction in drawings of all the Illinois state institutions and public buildings, sixteen in number.

THE WOMEN'S DEPARTMENT.

Making a Mince Pie.

There are many ways of making a mince pie. The Thanksgiving Day of 1891 is now past, but mince meat will be plenteous at Christmas and New Years. Aud it is never too late to know how to make a good thing. We receive the following from "the head of a household," since our last issue went to press:—

There are people, doubtless, who don't like mince pies, they're mighty few and nature played them a mean trick. But just because everybody likes mince pie it docsn't follow that everybody can get mince pie that is "mince pie as is mince pie." Of course every cook book in the land—and their name is legion—has one or more recipes for the genuine article, but—well, that's different. Now, here's a recipe that isn't in any cook book and came over in the Mayflower. And with the recipe are plain, common-sense directions that any housewife who knows the rudiments of cooking can understand.

"The proof's the eating" of mince pie as well as of puddings. If she will follow directions the eating will take care of itself.

First the ingredients of the mince meat. Here they are, with the quanity of each:

5 pounds beef.	1 ounce allspice.
1½ pounds suet.	2 ounces cinnamon.
1½ pecks apples.	1½pound currants.
2 quarts boiled cider.	1 pound raisins.
1 quart sweet cider.	1 cup molasses.
1 ounce cloves.	½ pint brandy.

This is a good recipe for good, honest mincemeat. Not a sign of a mystery or doubt of its homemade genuineness can be raised either before or after eating, which, in these days of factory table supplies, is considerable of a satisfaction. It is easily made—another thing in its favor—but in order to reach the perfection of "mother's mince pies" it must be carefully put together. You can't throw it together like two football teams in a scrimmage. Nor can you go to the 'phone and call up the market-man and tell him to send over a piece of meat for mince pie. That will not do at all. Go yourself. Select it from either shoulder or the round. If it is cut from the round see that it is taken from the upper part. Why? Because the hind quarter of beef is hung up by the shin-bone and the juices flow down, making the part that comes nearest the sirloin steaks the most desirable. Have it cut in a chunk rather than a thick slice, so there will be less cut surface exposed to the water while boiling, thereby preserving a greater portion of the nutriment of the beef.

Gilt-edge cook books have a way of intimating that it takes a knowing cook to boil water properly. It isn't all a joke either. Don't take your meat and throw it into a kettle full of cold water and let it boil till it's done. After washing the meat put it into a ketfle of boiling salted water and let it remain for ten or fifteen minutes. Then move the kettle back on the stove where it will simmer until done—about three hours. The cooking of the meat makes all the difference in the world with the success of the pie and the why and wherefore are plainly to be seen. Plain water boils at 212°, salted water at 224°. The addition of the salt increases the density of the water, requiring a little longer to reach the boiling point, by raising the temperature 12°. As the boiling water touches the surface of the meat it hardens the albumen, forming a kind of coating through which the juices of the meat will not pass, and the hotter the water the quicker the coating is formed. Allow one teaspoonful of salt to each quart of water. When the meat is done take it out on a plate and set away to cool.

Now comes the mechanical part of the process. Take out from the meat every part of fat and gristle and chop fine.

Beef suet is the only kind to be used. Break it into pieces, remove the membrane and chop in a cool place to prevent it from getting soft and sticky. A little flour sifted over it will keep it dry and prevent packing.

Any apple that is sour, solid, and juicy will do, but the preference is for Northern Spies or greenings, which are the richest of all cooking apples. Pare, core, and quarter them, being particularly careful to remove every husk, unless you would have your mincemeat bear the mark of the factory-made stuff. Chop a few at a time in order that the part in the bottom of the bowl may not be reduced to a mushy mass while that on top is still in large pieces.

Get the best quality of English currants, pick off the stems, and soak them in warm water for half an hour. Then put them in a colander and let water run through them for fifteen minutes, rubbing them through the hands occasionally to loosen the dirt. The raisins are not put in until the pie is made. Everything is now ready for the mixing.

This should be done with a wooden spoon. Commence with the meat. Measure it in a pint cup and to each pint add three pints of chopped apples. After stirring in half of the apples add the suet, currants, spices, molasses, and the boiled and sweet cider. In this way it is more thoroughly mixed, and there is but little stirring to be done after adding the last half of the apples. The brandy is not put in until the pies are made, as it looses its strength by standing.

There is nothing more to be done to the mincemeat now but to put it away in a crock and let it stand for a couple of days before baking to gain richness. It will take a five gallon crock to hold it, and there is enough for thirty pies. Everything included it has cost exactly as follows:

Meat	$ .63	Boiled cider	$ .50
Suet	.10	Sweet cider	.08
Apples	.60	Allspice	.03
Molasses	.05	Cinnamon	.05
Raisins	.18	Cloves	.03
Brandy	.60	Currants	.13
		Total	$2.98

There are several varieties of factory mincemeat, but the cheapest that is recommended comes in small packages at a shilling apiece. One of these—after it has had the necessary doctoring—will make two unsatisfactory light-colored pies. Besides, the meat has to be cooked twenty minutes before baking, and the extra materials to be added increase its original cost to more than that of the homemade mincemeat. Thirty pies made with factory meat will cost as follows:

Fifteen packages of meat	$1.88
Apples	.15
Cider	.80
Raisins	.18
Brandy	.60
Total	$3.61

They are only common, ordinary pies after all, and not above suspicion.

The battle is now half won and then comes the tug of war—the crust. Many a mince pie has come to grief right here, There are several kinds of pie crusts—the kind raised with baking powder that savors so strongly of the bake shop, the aristocratic puff paste that must be rolled with a glass rolling-pin on a marble slab and cooled between pans of ice before baking, and the kind mixed with cream, with butter cut in small pieces folded in just before rolling out. But the ordinary old-fashioned pastry is best of all. It doesn't require years of experience to make it and it has never been used to anything better than a wooden rolling-pin and board.

For pastry, for one pie take one and a half cups of flour, half a cup "shortening"—two-thirds lard and one-third butter, a pinch of salt, and about half a cup of ice water, just enough to get it in shape to roll out. Rub the flour, salt, and "shortening" together thoroughly until it is fine and powdery. While adding the water a few drops at a time take great care to mix it as well as possible. It is too much water and too much mixing after the water is added that make a crust tough. Divide the mixture into two parts and roll one of these to fit the tin. Roll lightly and always from you, as a heavy back-and-forth motion makes the crust solid and heavy.

Stir up the mincemeat well, as the apples and meat will rise to the top after standing, take out enough for one pie in a basin and stir in a dessert spoonful of brandy before putting in the tin.

Seed one-quarter cup of raisins. Their are two ways of doing it. One is to cut them in half and pick out the seeds, and the other is to pour boiling water over them, and after standing ten minutes rub between the thumb and first finger until the seeds come out. It doesn't matter much how it is done so long as the seeds do not get in the pie. Raisin seeds are in the same class as the apple husks, and never appear in a well-regulated pie. Place the raisins at regular spaces on top of the mincemeat, wet the edge of the bottom crust with water, and lay on the upper crust. Mark and press the two crusts together with the tines of a silver fork, and prick the top of the crust in a dozen or more places to give the steam a chance to escape. Bake thirty or forty minutes in a moderately hot oven.

A mince pie is good as long as it lasts—a virtue that is dear to the housekeeper's heart. She usually bakes a dozen at a time, and keeps them on tap all through the winter. Putting them in a hot oven a few minutes before serving makes them as fresh as the day they were baked. Put in a cold place the mincemeat will keep several weeks, but if there is any danger of it spoiling it can be canned. Put it in a porcelain kettle, a couple of quarts at a time, heat through thoroughly, and just before reaching the boiling point put it in glass jars and seal.

Do all this, and you will have cause to bless The American Engineer for the telling of it.

VISITING THE OLD FOLKS.

Wal, I've ben off, Lucindy Jane,
An' taken my vacation;
I tuk the cars to Ashfield town
By way of Deerfield station.

I didn't hev no call to go,
I wasn't sick nor ailin';
But wife she said I'd oughter, fur
She s'mised th' old folks was failin'.

So I sot out and tuk the train,
And when I'd fairly started,
I'll own right up, Lucindy Jane,
I did feel lighter hearted.

It did me good to see the fields,
The harvestin' and hayin';
The trees all seemed to nod to me
As if they was a sayin';

"You're welcome home, Johoshaphat,
You've ben a long time comin';"
The brooks they seemed to babble it,
The bees, too, in their hummin'.

And as I neared the old brown house,
Where you and I, Lucindy,
Was born and reared, and as I saw
An old face at the windy,

I'll own right up, Lucindy Jane,
There's something in a mother
That makes a man a child again;
And so, somehow or other,

Before I knew what she was at,
She had her arms around me,
And said: "Why, it's Jehoshaphat!"
And then my father found me.

And when I'd had a good square meal
Of fried cakes, pie and fixin's,
And honest country bread, yeast-riz,
Home made of mother's mixin's,

Then I sot out to see the town,
And when I'd asked how fur't 'is
To So and So's they'd up and say:
"So far from Mister Curtis'."

I paid the mortgage off the farm,
I had the roof new shingled,
And painted up the house new style
With red and yellow mingled.

I bought some rockers for the porch,
Where mother sets a knittin'
While in her comfortable lap
She holds the purring kitten.

And so I left them, better off,
With hired help to tend 'em,
And all the money that they need
I'm ready for to send 'em.

And I tell you Lucindy Jane,
It paid me for my trouble,
To see the dear old folks again,
If it had cost me double.

—*Springfield* (Mass.) *Republican.*

An Enterprising Woman.

A New York woman of forty-five years of age has been married to her fifteenth husband says the *Evening Lamp*. All of her husbands but the last are dead.

Continued on page 223.

CORRESPONDENCE.

Inexplicable Engine Cards.

Editor, American Engineer:

In your issue of October 24, I see engine cards from "Sub." He wants some one to enlighten him. In reply would say that he should give us something to work from. In the first place he should tell us what kind of an indicator he used; also speed of his piston, scale of indicator spring, and steam pressure of boiler. The cards look to me as if they were taken from a high speed engine, with a Richards indicator. But if they were taken with a Thompson, Tabor, or Calkins indicator, I would then say that the steam valve and piston are both leaking steam.

JERRY LEAHEY, JR.

Useful Packing.

Editor, American Engineer:

Here is a cheap and very durable packing for man heads and hand plates: Take old rubber belting and cut off a strip as long as required, and from one-fourth to five-eights inch wide, and wind around so that the edges will come next the face on the plate. And on the boiler, after it is wound on to the plate, slip a thread under where the last end comes, and tie it around to hold it in place until you can get it in.

I have used it for several years, and never found anything better; often taking out and putting in once in from two to four weeks for a year or more.

L. I. HILL.

The "A. E." is all Right.

Editor, American Engineer:

"I think the paper is getting to be the best mechanical paper we get hold of. At one time I thought there was almost too much nonsense about it; but now it is what we want—something to help us, and to keep us informed as to to the work of the Order and also concerning the progress made in steam devices, and valuable electrical information.

Geneva Council is all right—not a man out of work, and every one takes interest in the work of the Council and of the Order generally.

We have three great steam heater manuf cturing firms here: (1) The New York Central Iron Works, (2) The Dunning Steam and Hot Water Heater Co., (who have over 16,000 heaters in use), (3) Pierce, Butler and Pierce, who make the celebrated Florida Heater. Then there is the Furman Heater, by the Herendeen Co. We have more, and will write you concerning them another time.

HOMER M. SMITH, Chf. Engr.
Geneva Council, No. 13 N. Y., A. O. S. E.

First-Class Engineers.

Editor, American Engineer:

To help ourselves and to help others is a duty, that we as men and brothers owe to each other. It is a beautiful exemplification of manhood and brotherly respect that should always be uppermost in our hearts.

How beautiful this world would be if we, as brothers in A. O. S. E., and out of it as well, if we were bound by ties of friendship such as bound Damon to Pythias. If this friendship existed among engineers, what a blessed calling the trade or profession of an engineer would be!

I have derived much valuable information from the recent numbers of THE AMERICAN ENGINEER. The articles on electricity are highly appreciated by several engineers of my acquaintance, and the pointers given by Prof. Crocker and Dr. Wheeler are a great help. This electricity is a wonderful thing. It is a great boon and blessing, and by it power can be applied to almost everything, even to the extraction of a tooth, or destruction of an armored ship.

Electricity is now being placed in nearly all the principal buildings of Portland, and especially so in all the new buildings. Coal, oil and gas are fast taking a backseat here in the way of light. The writer has his house supplied with electric lamps, current being taken from the generator across the street in the P. A. Iec Co.'s factory. When the days arrive for cleaning boilers, and when any repairs have to be made, and no dynamo is running, that night a general howl meets the engineer and superintendent in charge when he enters his home, from the baby up. Coal oil lamps are no good then!

Now, I feel like saying something for our good boys. Without going into extremes, I am confident there is not a council of engineers in the U. S. that has got the weight, experience, goodlooks, capability—and engineers at present holding the positions that Multonomah Council contains! If there is, I should be pleased to hear from their Secretary. Here they are:

First, our Deputy, Bro. H. Coats, is a marine engineer of 12 years standing, and is now chief engineer on the Steamer Modoc, owned by the Union Pacific. Next our Chief Engineer, J. C. Cunningham, is a man of long experience, and at present is chief of a large furniture manufacturing company. Next our Past Chief, W. P. Fought, is at present Chief Engineer of the Northwest Cold Storage and Ice Co.; in his engine room you will find more machinery than would build an ocean steamer. Then comes our Jr. Past Chief, D. E. Welsh, chief engineer of the Pacific Coast Elevator Co., and he has one of the finest steam plants on the Pacific Coast.

Then Bro. M. W. Ingalls, who left us last month to accept an important position in a Utah Sugar Refinery, is a man of excellent ability. And our Recording Secretary, Bro. B. S. Castell, who is in the position of chief engineer of the city water works, is a jolly good fellow, and is an able electrician; he has many talented friends. Next comes our Corresponding Engineer, W. E. Harris, who has served his time on many river steamers, and is now the mechanical engineer for the Portland Art Ice Co.'s Machinery Department, where he has been located for the past five years. Then our Financial Engineer, Bro. James Gill, chief engineer of the Portland Cordage Co., is a draftsman, inventor and a man of thorough experience; he has just applied for a patent on a simple adjustment of connecting the indicator to the cross-head, and reducing motion.

With Bro. Gill's method any engineer can take a card from his engine at any time within a period of ten minutes. You don't have to stop to connect up or take off; it is one of the greatest adjuncts to a steam engine in existence.

Next our Treasurer, Bro. M. F. Coberth, the chief engineer of the Williamette Steam Mills Co.; he is at the throttle of a three thousand five hundred horse power consolidated improved Wheelock engines, lately put in by the California Engineering Co. Bro. Corberth has been employed in this mill for the past ten years, and the old slide valve engine were put to a severe test in this mill for years (now gone by), and were nearly worn out; and it was only by working early and late that they were kept up to duty. Bro. Coberth now feels happy, to be in his well-earned and spacious engine room. He meets his many friends now with a smile.

Next comes our Chaplain, Bro. Uhlman, the able chief of Inman Paulson's Steam Saw Mill on the East Side. He fills this position admirably, and is a man of long experience, and he is a genial good fellow all round.

Next comes our Senior Master Mechanic, Bro. Charlie Traves, who has just been raising Ned here on the coast—putting in all the heavy power plants. He erected the big engines in the Williamette Steam Mills and cable road over at Seattle; and now he is just finishing up the great Union electric power plant. After this is in, he is to put in a plant at Walla Walla, and then return to accept the position of Chief of Mechanical Department of the electric power plant. Charlie is a good-natured, genteel, and able man of whom we all feel proud.

Next our Jr. Master Mechanic, Wm. T. Smith, now of Eugene, who has just this summer put in an ice plant and brewery, is a qualified engineer, and able to acceptably fill any position.

Inside Sentinel Hutton, of the Gambrinus Brewing Co., has more engines, pumps, boilers, compressors, etc., under his charge than any man on the coast. But he keeps his head straight, and everything runs smoothly.

Outside Sentinel Hawkins is the able engineer and mechanic of the wholesale house of Palmer, & Rey. In printing machinery, boilers and engines, etc., Bro. Hawking takes great pride in the council; and in his engine room, neatness and good work is seen on every hand. He is an able man in every way.

Trustee Sam Gill, is now master mechanic for the U. S. Engineers at the mouth of the Columbia. He has several locomotives, hoisting engines, and shops under his charge. Words as to his ability are unnecessary.

Bro. J. C. Hamilton, the chief engineer of the East Portland Electric Light and Water Co., is a man of wide experience and noble character. No ordinary man could fill his place.

Then our Bro. Davis is chief engineer on the government steamboat "Cascades." She is a powerful steamer, and Bro. Davis is held in high esteem by the officers of his boat.

Our Bro. Myers is chief of a large planing mill on the East Side. He is a very competent man, and is always happy. We envy Mr. Myers, as he is a most splendid looking young fellow, and has many admirers among the fair sex.

The good old stand-by, Bro. J. C. Demmers, who put up the first electric light plant in San Francisco, and operated the same with naked wires, is now with Church & Lawson. He is an acknowledged expert on all intricate and delicate matters, and he is kept busy on armatures and other repairs.

Bro. Geo. Parrish, who is electrical engineer for Russell & Co., is a most competent and trustworthy man. He is also a very competent mechanic on all kinds of machinery. Then comes Bro. Schmidt, a good whole-souled fellow, who is now with Bro. Traves in the Union power house.

And last, but not least, we have a most deservedly popular young engineer, with a practice from his boyhood up, and he is every inch of him a man and true brother. He is prompt on time at our meetings and makes others feel at home in his company.

Now, Mr. Editor you will take notice that all these men in this council are men who are chiefs and have from one to ten men under their charge. This council is in it and don't you forget it. We are able to figure on anything, from a needle to a man of war. We have not tried to produce rain yet, for we are getting plenty now.

Finally, be it resolved that we like THE AMERICAN ENGINEER and will give it our hearty support.

ONE OF THE BOYS.

NEW ENTERPRISES.

COLORADO.

Denver.

The capacity of the Tramway power house on Grand avenue, between Third and Fourth avenues, is being doubled. A large addition is being put on the building and a 1,000-horse power Corliss-Hamilton engine is to be put in, with thirteen new dynamos. It is expected that the work will be completed in about six weeks. Engineer B. H. Fisher, who has charge of the plant, is making a number of improvements in the switchboard and the various electrical appliances about the building, and when all the changes have been completed the power house will be one of the finest in the country, they claim.

The new stoneware and pottery manufactory that is to locate on Fletcher's West side property is taking definite shape. An order for $20,000 worth of Corliss engines has been given and ground will be broken for the erection of the buildings just as soon as the plans are completed.

OHIO.

Canton.

The Champion Stoneware Co., of this city, recently destroyed by fire, will be rebuilt in about 60 days.

The Bonnott company is an important addition to the special industry of this city. Canton is already noted for its fine brick and pottery ware, so that it may be said that with the superior clay in this locality, Canton is sure to be the center of clay industry. The Bonnot company was incorporated a short time since with a capital stock of $100,000, and the work of getting ready for business is being pushed rapidly forward says the *News-Democrat*. The officers of the new company are: M. D. Harter, president; H. W. Harter vice president; H. H. Whiting, secretary and treasurer; A. Bonnot, superintendent. The Peerless Reaper company plant passes into the hands of the Bonnot company. This new concern will be in the business of supplying the machinery for brick and pottery plants. All kinds of machin-

ery required for the preparing and working of clay, can be had of this company. The old time methods of work have given place to machinery of the latest inventions, and the Bonnot company builds such machinery as every pottery and brick plant needs. The Bonnot Bros., formerly of Louisville, are stock holders in this new company, and their machinery and patterns have been placed in the Peerless plant so that the work will now go rapidly forward.

WEIGHT OF GALLON OF DISTILLED WATER.

By JEREMIAH LEAHEY, JR.

Temp. Fah.	United States.	New York.	Imperial.	Temp. Fah.	United States.	New York.	Imperial.
32	8.3438124	8.0124837	10.0129049	123	8.2428654	7.9115367	9.9129588
33	8.3440584	8.0127297	10.0141518	124	8.2420900	7.9107613	9.9121834
34	8.3443206	8.0129919	10.0144140	125	8.2397931	7.9084644	9.9098865
35	8.3444843	8.0131536	10.0145757	126	8.2375293	7.9062006	9.9076227
36	8.3446978	8.0132691	10.0146912	127	8.2353810	7.9040523	9.9054744
37	8.3447364	8.0134077	10.0148298	128	8.2327245	7.9013958	9.9028179
38	8.3448288	8.0135001	10.0149212	129	8.2301845	7.8988548	9.9002769
39.3	8.3448750	8.0135463	10.0149684	130	8.2287051	7.8973764	9.8987985
40	8.3448519	8.0135232	10.0149452	131	8.2265568	7.8952281	9.8966502
41	8.3448055	8.0134770	10.0148990	132	8.2244316	7.8931029	9.8945250
42	8.3447133	8.0133846	10.0148067	133	8.2221447	7.8908160	9.8922371
43	8.3445747	8.0132460	10.0146681	134	8.2199195	7.8885909	9.8900129
44	8.3444130	8.0130843	10.0145064	135	8.2177326	7.8864039	9.8878260
45	8.3442051	8.0128763	10.0142985	136	8.2154698	7.8841400	9.8855622
46	8.3440431	8.0127157	10.0141368	137	8.2132050	7.8818763	9.8823984
47	8.3439279	8.0126992	10.0140213	138	8.2109181	7.8795994	9.8810115
48	8.3433966	8.0121579	10.0134900	139	8.2085157	7.8771870	9.8786091
49	8.3431425	8.0118138	10.0132357	140	8.2071133	7.8757846	9.8772067
50	8.3427269	8.0113982	10.0128203	141	8.2036881	7.8723691	9.8737812
51	8.3423018	8.0109731	10.0123952	142	8.2013085	7.8699798	9.8714019
52	8.3419413	8.0106129	10.0120345	143	8.1989061	7.8693774	9.8707995
53	8.3414100	8.0100813	10.0115034	144	8.1964806	7.8651519	9.8665740
54	8.3408556	8.0095269	10.0109490	145	8.1940782	7.8627495	9.8641716
55	8.3403474	8.0090185	10.0104408	146	8.1926768	7.8613471	9.8627696
56	8.3397930	8.0084643	10.0098864	147	8.1891348	7.8678061	9.8592282
57	8.3391231	8.0077944	10.0091965	148	8.1867322	7.8554038	9.8568256
58	8.3385918	8.0072631	10.0086852	149	8.1841914	7.8538627	9.8542948
59	8.3379219	8.0065932	10.0080153	150	8.1816504	7.8503217	9.8517438
60	8.3371134	8.0057847	10.0072068	151	8.1792094	7.8478807	9.8493028
61	8.3363511	8.0050224	10.0064445	152	8.1765684	7.8452597	9.8466618
62	8.3356581	8.0043294	10.0059311	153	8.1739119	7.8426132	9.8440053
63	8.3349189	8.0035902	10.0040132	154	8.1713478	7.8400291	9.8414412
64	8.3339025	8.0025738	10.0039959	155	8.1700293	7.8387006	9.8401227
65	8.3331121	8.0017884	10.0032105	156	8.1660117	7.8346830	9.8361051
66	8.3321600	8.0008313	10.0022534	157	8.1633321	7.8320034	9.8334253
67	8.3312460	7.9999176	10.0013394	158	8.1607911	7.8294624	9.8308845
68	8.3302189	7.9988908	10.0003116	159	8.1581115	7.8267828	9.8282049
69	8.3283980	7.9970693	9.9984914	160	8.1553164	7.8239877	9.8254098
70	8.3283946	7.9970659	9.9984870	161	8.1526368	7.8213081	9.8227304
71	8.3273652	7.9960365	9.9974586	162	8.1512970	7.8199683	9.8213904
72	8.3263026	7.9949739	9.9963960	163	8.1471621	7.8158334	9.8172555
73	8.3252169	7.9938882	9.9953103	164	8.1444838	7.8131538	9.8145759
74	8.3250543	7.9937255	9.9951477	165	8.1416874	7.8103587	9.8117808
75	8.3230917	7.9917630	9.9931851	166	8.1388692	7.8075405	9.8089626
76	8.3220060	7.9906773	9.9920994	167	8.1360741	7.8047454	9.8061675
77	8.3208048	7.9894761	9.9908982	168	8.1333945	7.8020608	9.8024879
78	8.3196036	7.9882749	9.9896970	169	8.1305763	7.7992476	9.8006697
79	8.3185411	7.9872124	9.9886345	170	8.1276426	7.7963139	9.7977360
80	8.3172012	7.9858725	9.9872946	171	8.1248475	7.7934988	9.7949409
81	8.3160000	7.9846693	9.9860934	172	8.1220293	7.7907006	9.7921227
82	8.3147988	7.9834701	9.9848923	173	8.1192111	7.7878824	9.7893045
83	8.3134593	7.9821306	9.9835527	174	8.1152148	7.7838861	9.7853082
84	8.3121192	7.9807905	9.9822126	175	8.1135978	7.7822691	9.7836912
85	8.3107794	7.9794507	9.9808728	176	8.1106641	7.7776049	9.7807575
86	8.3094396	7.9781109	9.9795330	177	8.1078690	7.7765403	9.7779624
87	8.3081229	7.9767942	9.9782163	178	8.1048522	7.7735235	9.7749456
88	8.3067831	7.9754544	9.9768765	179	8.1021171	7.7708884	9.7722105
89	8.3054433	7.9741146	9.9756367	180	8.0991603	7.7678316	9.7692537
90	8.3053045	7.9739758	9.9753979	181	8.0962266	7.7648979	9.7653200
91	8.3024855	7.9711587	9.9725799	182	8.0934315	7.7621028	9.7635242
92	8.3008926	7.9695639	9.9709860	183	8.0897048	7.7583761	9.7597982
93	8.2994142	7.9680885	9.9695076	184	8.0874024	7.7560737	9.7574958
94	8.2978470	7.9665183	9.9679404	185	8.0844697	7.7531400	9.7545621
95	8.2963419	7.9650132	9.9664353	186	8.0813964	7.7500677	9.7514898
96	8.2947480	7.9634186	9.9648414	187	8.0784396	7.7471109	9.7485330
97	8.2930165	7.9616868	9.9631089	188	8.0755059	7.7441727	9.7455993
98	8.2913985	7.9601698	9.9614919	189	8.0724336	7.7411049	9.7425270
99	8.2906660	7.9593373	9.9607594	190	8.0696154	7.7382867	9.7401088
100	8.2879335	7.9593048	9.9607269	191	8.0665094	7.7352144	9.7366365
101	8.2863165	7.9549878	9.9564099	192	8.0636094	7.7322807	9.7337028
102	8.2845840	7.9532558	9.9546774	193	8.0605371	7.7292084	9.7306305
103	8.2832203	7.9509915	9.9524136	194	8.0574648	7.7261361	9.7275582
104	8.2811200	7.9497913	9.9512334	195	8.0543925	7.7230638	9.7244859
105	8.2792479	7.9479136	9.9493413	196	8.0513202	7.7199915	9.7214136
106	8.2774923	7.9461636	9.9475857	197	8.0482479	7.7169192	9.7183413
107	8.2774913	7.9444311	9.9458536	198	8.0468840	7.7138238	9.7152459
108	8.2738885	7.9425600	9.9439821	199	8.0420802	7.7107515	9.7121736
109	8.2720176	7.9406889	9.9421110	200	8.0388693	7.7075406	9.7089627
110	8.2701455	7.9388178	9.9402399	201	8.0356815	7.7043528	9.7057749
111	8.2682754	7.9369467	9.9383685	202	8.0325861	7.7012574	9.7026794
112	8.2666063	7.9352776	9.9366997	203	8.0292597	7.6979310	9.6993531
113	8.2646332	7.9333045	9.9347266	204	8.0261874	7.6948581	9.6962808
114	8.2626621	7.9313334	9.9317555	205	8.0228379	7.6915092	9.6929313
115	8.2606524	7.9293237	9.9307458	206	8.0196267	7.6882980	9.6897201
116	8.2587582	7.9274295	9.9288509	207	8.0162775	7.6849488	9.6863709
117	8.2567485	7.9254198	9.9268419	208	8.0130897	7.6817610	9.6831831
118	8.2547838	7.9234545	9.9248766	209	8.0097399	7.6784112	9.6798333
119	8.2526367	7.9213080	9.9227301	210	8.0065293	7.6752006	9.6766227
120	8.2506270	7.9192983	9.9207204	211	8.0031798	7.6718511	9.6722732
121	8.2484787	7.9171500	9.9185721	212	7.9998534	7.6685247	9.6699468
122	8.2467310	7.9156023	9.9170244				

THE WOMEN'S DEPARTMENT.

Continued from page 220.

Women the Equal of Man.

Col. Robt. G. Ingersoll, the smooth-tongued infidel, recently lectured in Chicago on "Liberty." He likes women better than "heaven." Anyway he is a great admirer of the "weaker vessel." And this is what the popular "Bob" said of them in his Chicago "Liberty" talk:

If men have been slaves, what about women—the slaves of slaves? Let me say right here, to-night, I regard marriage as the holiest institution among men. Without the fireside there is no human advancement; without the family relation there is no life worth living. Every good government is made up of good families. The unit of government is the family, and anything that tends to destroy the family is perfectly devilish and infamous. I believe in marriage, and I hold in utter contempt the opinions of long-haired men, and short-haired women who denounce the institution of marriage, (great applause and laughter). Let me say right here—and I have thought a good deal about it—let me say right here, the greatest ambition that man can possibly have is to so live and so improve himself in heart and brain as to be worthy of the love of some splendid woman (applause); and the grandest ambition of any girl is to make herself worthy of the love and adoration of some magnificent man. [Applause.] That is my idea, and there is no success in life without it. If you are the grand Emperor of the world, you had better be the grand emperor of one loving and tender heart, and she the grand empress of yours. The man who has really won the love of one good woman in this world—I do not care if he dies in the ditch a beggar—his life has been a success. [Applause.] I say it took millions of years to come from the condition of abject slavery up to the conditions of marriage. Ladies, the ornaments you bear upon your persons to-night are but the souvenirs of your mothers' bondage. The chains around your necks and the bracelets clasped upon your wrists by the thrilling hand of love have been changed by the wand of civilization from iron to shining, glittering gold; but nearly every religion has accounted for the devilment in this world by the crime of woman. What a gallant thing that is! And it is true I had rather live with the woman I love in a world full of trouble than to live in heaven with nobody but men. [Laughter and applause.]

Now, my friends, it seems to me that the woman is the equal of the man. She has all the rights I have and one more, and that is the right to be protected. That's my doctrine. You are married; try to make the woman you love happy; try to make the man you love happy. Whoever marries simply for himself will make a mistake; but whoever loves a woman so well that he says: "I will make her happy," makes no mistake, and so with the woman who says, "I will make him happy." There is only one way to be happy, and that is to make somebody else so, and you can't be happy cross lots; you have to go the regular turnpike road. [Laughter.]

If there is any man I detest it is the man who thinks he is the head of the family—the man who thinks he is the "boss!" [Laughter.] That fellow in the dugout used that word "boss" [Laughter] that was his favorite expression; that he was "boss." [Laughter.] Imagine a young man and a young woman courting, walking out in the moonlight and the nightingale sing a song of pain and love, as though the thorn touched her heart—imagine them stopping there in the moonlight and starlight and song and saying: "Now here, let's settle who's boss!" [Laughter,] I tell you it is an infamous word and an infamous feeling—a man who is "boss," who is going to govern in his family, and when he speaks let all the rest of them be still, some mighty idea is about to be launched from his month. Do you know I dislike this man unspeakably; and a cross man I hate above all things. What right has he to murder the sunshine of day? What right has he to assassinate the joy of life? When you go home you ought to feel the light there is in the house; if it is in the night it will burst ont of the doors and windows and illuminate the darkness. It is just as well to go home a ray of sunshine as an old, sour, cross curmudgeon, who thinks he is the head of the family. Wise men think thei mighty brains have been in a turmoil, they have been thinking about who will be the alderman from the Fifth Ward; they have been thinking about politics, great and mighty questions have been engaging their minds; they have bought calico at eight cents or six, and want to sell it for seven. Think of the intellectual strain that must have been on a man, and when he gets home everybody else must look out for his comfort. A woman who has taken care of five or six children, and one or two of them may be sick, has been nursing them and singing to them, and taking care of them, and trying to make one yard of cloth do the work of two—she, of course is fresh and fine and ready to wait upon this great gentleman—the head of the family. [Laughter.] I don't like him a bit!

Do you know another thing? I despise a stingy man. I don't see how it is possible for a man to die worth $50,000,000 or $10,000,000 in a city full of want, when he meets almost every day the withered hand of beggary and the white lips of famine.

LITTLE CHILDREN AS SLAVES.

Now, if women have been slaves, what shall we say of little children? The children are just one shade worse than the women. Most people have an idea about bringing up children, instead of letting them grow. [Laughter.] You furnish a climate in the house, and the children will grow beautiful; but you must furnish the climate. In your house must be the climate of kindness, of honesty, of justice of generosity, and just as long as that climate exists those children will grow free and fair and beautiful. I have pity for the children—the children of the poor, the children of the rich, the children of the gutter and of the palace, the children of the criminal classes—and the still more criminal classes. I have had sympathy with them all, because they have no liberty. If you want your children to tell the truth you must stop lying to them. [Laughter and applause.] Over in Michigan I heard a story about a little boy at Grand Rapids. His father and mother had often promised to take him out riding, but they always evaded him. One day he caught them just as they were driving away, and he said to the nurse who brought him to the door: "There goes the two worst liars in Grand Rapids," [Laughter and applause.] I do not believe children can be made honest through fear. There is no reforming power in fear. You may scare a man so badly he won't do a certain thing, but I will take my oath you can't frighten him to that degree that he won't want to do it, [laughter and applause,] and as long as he wants to there is no reformation. There is no reforming power in brutality. Children will grow only in the climate of kindness, in the climate of goodness. Give them a chance to be honest. If your child tells a lie, tell him you have told lots of them, and you have found out it is a bad policy. [Laughter.] Don't pretend to be a saint, because after awhile your child will see through your robes. [Laughter.] Let us be perfectly free and frank with each other. Tell your boy you "have never done anything worse than I have done, and probably never will." [Applause.] When your child commits a wrong take it in your arms, let it feel your heart beat against its heart, and let the child know that you really, and truly, and sincerely love it.

Women in the Field.

Miss Annie E. Allen is the local editor of the *Friendly Farmer*, Wilton Junction, Ia. Her sister Laura has full control of the job printing department.

A woman at Portsmouth, Eng., is a teacher of navigation, and many of her pupils have successfully passed the board of trade examinations and got positions as mates and skippers.

Mrs. P. V. M. Raymond, of Lincoln, Neb., has for five years trained the oratorio chorus classes of Lincoln; and this year, by special request of the societies, she conducted their musical festival with great success.

The Pauret sisters are very successfully conducting a printing and publishing house in Brussels, which was founded by their father. One sister is a poet and the other edits *La Petite Revue Belge*, the first illustrated juvenile periodical ever published in Belgium.

HOW TO BECOME A LICENSED ENGINEER.

A man can not become a thoroughly useful engineer by mere book learning; he must have experience in the work. On the other hand, book instruction (if plain, complete, and easily understood) is a great help to the practical engineer. Stephenson's illustrated "Practical Test," examination and ready reference book* is intended to help stationary, locomotive, and marine engineers, also firemen, electricians, and machinists, to procure a steam engineers' license. Such is the announcement on the title page of the book. The language is certainly simple enough, and it may afford a good start to beginners.

NEVER DONE.

"I am now convinced," said Tompkins, "that woman's work is never done."

"What leads you to that conviction?" asked Smythe.

"The fact that Mrs. Tompkins, after working me half the night for a sealskin sack began blithely this morning on a new set of parlor furniture."—*New York Herald.*

LITERARY NOTES.

"How to Become an Engineer" (that is, a civil engineer) is the title of No. 100 of the Van Nostrand Science Series, by Geo. W. Plympton, A. S. C. E; price 50 cents. The D. Van Nostrand Co., New York, are the publishers. The book is for sale also by A. C. McClurg & Co., Wabash ave., Chicago.

"The Practical Catechism," by Robert Grimshaw, M. E., Ph. D., has just been published by John Wiley & Sons, New York. This new volume is addressed and commended to practical men. The questions are those that often confront such men, and the answers furnish the information desired. The general topics treated are air, alloys, beams, belts, bricks, buildings, calculations, cement, combustion, disinfectants, foods, fuels, gas, gear wheels, gravity, hydraulics, iron and steel, locomotives, lubrication, mechanical process, metals, plants, power, railways, ropes, saws, shafting, strength of materials, temperatures, waters, weight, wines, works, etc. This book comes like a general supplement to Dr. Grimshaw's "Steam Engine Catechism," "Engine Runners' Catechism," "Pump Catechism," "Boiler Catechism," and "Hints to Power Users."

Miss Mamie Dickens, who was always known as the favorite daughter of Charles Dickens, has written, for the Christmas number of The Ladies' Home Journal, her first story. It is a semi-ghost tale of the romance of an old English manor. Miss Dickens' only piece of literary work previous to this story was the editing of her father's letters for publication. She is said to possess true literary talent.

Robert J. Burdette, the humorist, is to go into the editorial harness again. With January 1st, he will become a salaried editor on the staff of The Ladies' Home Journal, and will conduct a regular department in each issue of the periodical.

The Christmas Number of Scribner's Magazine contains ten illustrated articles, in which is represented some of the best work of well-known artists, following the precedent of previous Christmas issues, there is an abundance of short fiction. There are a poetic legend of the first Christmas tree entitled "The Oak of Geismar," by Henry van Dyke; a stirring tale of the Franco-Prussian War, "A Charge for France," by John Heard, Jr., with

* Published by Walter G. Kraft, 70 La Salle St., Chicago; price, $1.

illustrations by Marchetti, the emient French artist and pupil of Detaille; an artist's story of "Espero Gorgoni, Gondolier," by F. Hopkinson Smith, with the author's own illustrations; another of George A. Hibbard's charming short stories, entitled "A Fresh-water Romance," a tale of the great lakes, the interest of which centres about an old propeller; and "A Little Captive Maid," by Sarah Orne Jewett, which is the story of a cheery Irish girl, whose services made easy the last years of an old New England sea-captain. This instalment of Mr. Stevenson's story, "The Wrecker," describes vividly a a voyage on the Pacific, and the arrival at the deserted island and the wreck around which the action of the story moves. In addition to this noble fiction, is an appreciative article on Albert Moore, the English painter, who passed fifty years of age without recognition by the Royal Academy, and yet has achieved a unique position with artists and critics for the original quality of his work. The most richly illstrated articles in the number is "Afloat on the Nile," by Mr. and Mrs. E. H. Blashfield, which describes the voyage in a dahabeeyeh from Cairo to the Cataract, illustated by Mr. Blashfield's own sketches; Charles F. Lummis contributes the first of a group of short papers on the little-known region of New Mexico and Arizona, which he calls "The Land of Poco Tiempo" (the land of Pretty Soon). For a number of years Mr. Lummis has lived in this region, and has been making a unique series of photographs from which selections will be made for his articles. Miss Guiney's ballad of "Peter Rugg, the Bostonian," is illustrated with twelve pen drawings by Howard Pyle; and "Peleus to Thetis," by Bessie Chandler, has elaborate decorations by Herbert Denman. Several unillustrated poems and the Point of View complete the Christmas issue, which appears with a special cover-design by Will H. Low

What A Magazine Costs.

A very good idea of the amount of money it costs to successfully conduct one of the magazines of to-day is aptly illustrated in some figures regarding the editorial cost of *The Ladies' Home Journal* of this city, says the Philadelphia *Public Ledger*. The *Journal* is edited by Mr. Edward Bok. For shaping the thoughts of his 750-000 women readers each month Mr. Bok is paid $10,000 per year, and has an interest in the business besides which nets him fully twice his salary. He has a staff of sixteen salaried editors, which includes men and women like Rev. Dr. Talmage, Robert J. Burdette, Palmer Cox, Margaret Bottome, Isabel Mallon and Maria Parloa. The combined salaries of these editors exceed $20,000 a year. The *Journal* spends each month $2,000, or about $25,000 per year on miscellaneous matter not contributed by its regular editors, and the working force in the editorial department means at least $6,000 more in salaries, making over $60,000 a year, and this represents but a single department of the magazine; and I question whether any periodical is conducted on a more business-like and economical basis than is the *Journal*. No wonder that J. B. Lippincott, when asked by a friend why he did not keep a yacht: replied " A man can only sustain one luxury—I publish a magazine!"

SPRINGFIELD REPUBLICAN FOR 1892.

An independent, complete and able newspaper; the representative journal of New England. Established in 1824 by Samuel Bowles.

Published daily, Sunday and weekly.

The Springfield Republican is emphatically a newspaper for the people. It publishes all the news that is news in the broadest and highest sense, unaffected by partisan or personal prejudice. It is enterprising, alert and intelligent in the performance of its duties to the public. It has its own decided opinions on public questions, and these opinions are expfessed with vigor and ability, but they are not allowed to color its news columns. *The Republican* is a thoroughly fair journal. Members of all parties who desire to keep informed of the important political events and discussions of the presidental campaign of 1892, should subscribe for *The Republican*.

The Daily Republican was started in 1844, and is the oldest daily paper in the state outside of Boston. It has always kept abreast of the times, and has been quick to avail itself of the best modern appliances for the enlargement and improvement of its new service. It is now regularly an eight-page sheet with seven wide columns to the page, and supplemental pages are frequently added as the demand of news or advertising require. It covers the news of the world with discriminating care and thoroughness. New England happenings and interest receive special attention and liberal space, and a large force of special reporters and correspondents are constantly employed in gathering the local news of Western Massachusetts and the neighboring counties of Connecticut, Vermont and New Hampshire for its readers. Its editorial page is broad in range, independent, elevating and interesting in quality. Its literary department is of a remarkably high order. Its political correspondence is furnished by independent, well-informed and capable writers. It publishes, moreover, a great variety of interesting and valuable general correspondence and selections.

The Sunday Republican was first published in 1878 in response to a real public demand in Western Massachusetts for a first-class high-toned Sunday newspaper. Since that time it has been constantly improved and it has been twice enlarged Fully four-fifths of its 56 columns of space is devoted to reading matter of a high order, embracing news, special correspondence, a full page of editorial matter, a department of books, authors and art, a first-rate weekly story and a weekly sermon, sporting and theatrical news and notes, special articles, original and selected poetry, etc., *The Sunday Republican* is a thorough wholesome, excellent and interesting journal, well adapted to the tastes and wants of the intelligent New England public.

The Weekly Republican is now more than 67 years old, but age only improves its quality. It continues to be what it has long been, a remarkably faithful and comprehensive record of American life. Its weekly review of the news is very carefully compiled, and its 12 broad pages contain in addition to the news, wonderfully rich collection of valuable and entertaining reading matter. All the best features of *The Daily* and *Sunday Republican* are reproduced in *The Weekly* in full or but slightly abridged, and arranged with admirable skill and intelligence for the convenience and pleasure of the reader. The result is a weekly news and family journal which far exceeds in interest and worth any similar publication in the United States It is a paper New Englanders at home and abroad will find of special value, and which Americans everywhere can appreciate and enjoy.

Subscription Rates.—Daily: 70 cents a month, $2 a quarter, $8 a year. Sunday: 50 cents a quarter, $2 a year. Weekly: 50 cents for six months, $1 a year. All subscriptions are payable strictly in advanoe. Specimen copies free.

Free for one Month.—*The Weekly Republican*, a 12-page paper will be sent free for one month, to any one who wishes to try it. New subscribers to *The Weekly* for 1892 can have the paper free for the balance of 1891.

Address The Republican, Springfield, Mass.

BUSINESS NEWS.

The Sioux City Engine Works have shipped the following: State University, Lincoln, Neb., one 9½ & 15x18 high speed compound; J H. Hertsche, Hamburg, Iowa, one 18x36 Corliss; Salina Paper Mill Co., Salina, Kansas, one 20x42 and one 12x36 Corliss; Caldwell & Sons, Chicago, one 14x36 Corliss; Stella Corn Meal Mill Co., Stella, Neb., one 11x16 high speed.

A GERMAN CONSTRUCTOR OF MACHINES

wants an appropriate position in a machine factory of good standing. He is 26 years old and has, after thorough study of five years, passed a state examination. He is a good and quick designer, especially reliable in the construction and projection of steam engines and in the erection of pumps, water and air compression plants.

Expectation of salary m ei Please address offers to I.H. 8638, care Rudolph Mosse, Berlin S. W., Germany.

RESPONSIBLE POSITION WANTED.

Mechanical Engineer, competent to design, construct, estimate cost, supervise erection, etc., of general machinery and wrought iron work, with practical and theoretical experience, desires a responsible position in any part of the country. Ad. M. E., care of the American Engineer, Pontiac Building, Chicago.

CHICAGO, MILWAUKEE & ST. PAUL RAILWAY.

Electric Lighted and Steam Heated Vestibuled Trains, with Westinghouse Air Signals, between Chicago, St. Paul and Minneapolis, daily.

Electric Lighted and Steam Heated Vestibuled Trains between Chicago, Council Bluffs and Omaha, daily.

Through Vestibuled Sleeping Cars, daily, between Chicago, Butte, Tacoma, Seattle, and Portland, Ore.

Solid Trains between Chicago and principal points in Northern Wisconsin and the Peninsula of Michigan.

Daily Trains between St. Paul, Minneapolis and Kansas City via the Hedrick Route.

Through Sleeping Cars, daily, between St. Louis, St. Paul and Minneapolis.

The finest Dining Cars in the World.

The best Sleeping Cars. Electric Reading Lamps in Berths.

6,100 miles of road in Illinois, Wisconsin, Northern Michigan, Iowa, Minnesota, Missouri, South Dakota and North Dakota.

Everything First-Class.

First-Class People patronize First-Class Lines.

Ticket Agents everywhere sell Tickets over the Chicago, Milwaukee and St. Paul Railway.

Map of the United States.

A large, handsome map of the United States, mounted and suitable for office or home use, is issued by he Burlington route. Copies will be mailed to any address on receipt of 12 cents in postage by P. S. Eustis, Gen'l Pass. Agent, C., B. & Q. R. R., Chicago, Ill.

CONTRACTS OPEN.

Comptroller's Office,
City of New Orleans,
New Orleans, Nov. 20, 1891.

Sealed Proposals will be received at this office until the hour of 12 m., Thursday, February 18, 1892, for the construction of a new drainage pump, in accordance with plans and specifiations on file in the office of the City Engineer. Copies of plans and specifications will be forwarded by mail on request.

A deposit of $200 will be required to accompany each bid.

The city reserves the right to reject any and all bids.

All in conformity with Ordinance No. 5753, C. S., adopted Nov. 10, 1891.

F21 Otto Thoman, Comptroller.

Drawbridge.— Competitive plans for a drawbridge across the Duluth ship canal will be received by the board of public works in and for the corporation of the city of Duluth, Minn., until 2 p. m. on the 28th day of Debember, 1891, said plans to be drawn according to notes and specifications for the size and strength now on file in the office of said board, which will be furnished upon application. A cash prize of one thousand (1,000) dollars will be paid for the best plans furnished. Said plans must be accompanied with detail specifications and approximate cost of said bridge. The successful bidder in all probability will, if so desired, be engaged by the city of Duluth when the bridge is built to superintend the building of the same.

Official Seal. Henry Truelsen, President. T. W. Abell, Clerk, Board of Public Works.

Water-Works Franchise.—The city of Cape Girardeau, Mo., desires to let a franchise to a private company to build and operate Water-Works. Plans and specifications are now on file with the undersigned, and with Johnson & Flad. Consulting Engineers, Laclede Building, St. Louis.

Sealed proposals will be received up to 6 o'clock p. m. Monday, the 7th day of December, 1891.

Other systems will be investigated if submitted.

The Mayor and Council reserve the right to reject any or all bids. H. P. Pibronnot, Mayor. Attest, Geo. E. Chappell. City Register.

Water-Works.—Sealed proposals will be received until 3:30 P. M., Nov. 30, 1891, by the City Clerk of Hammond, Ind., for the construction of a system of water-works including the furnishing and laying of 25,750 lineal ft. of 16-in. cast iron pipe, and one vertical horizontal pump of 3,000,000 galls. capacity.

Plans and specifications may be seen, or obtained, at the office of the Engineer, C. McLennan, C. E., 308 Opera House Block, Chicago, Ill.

Firms bidding must give individual names and furnish certified check in the sum of one thousand dollars ($1,000) payable to the City Clerk which shall be forfeited to the city on failure to execute contract, in accordance with terms, if awarded same. The right to reject any or all bids reserved. Bids must be sealed and indorsed "Proposal for the construction of Water-Works." J. B. Woods. City Clerk.

Stean Heating.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until the 11th day of December, 1891, for all the labor and materials required to fix in place complete the low pressure, return circulation steam heating and ventilating apparatus for the United States Post Office, etc., building at Jackson, Mich., in accordance with the drawings and specification, copies of which may be had at this office, or the office of the superintendent at Jackson, Mich. Bids will be considered for any other system of heating and ventilating, in lieu of the above' and parties proposing to supply such must submit, with their proposal, plans and full specification for same. Each bid must be accompanied by a certified check for a sum not less than 2% of the amount of the proposal. Proposals must be sealed and marked "Proposals for the low Pressure, Return Circulation, Steam Heating and Ventilating Apparatuus (or otherwise, as the case may be) for the United States Post Office Building at Jackson, Mich.," and addressed to W. J. Edbrooke, Supervising Architect.

Sealed Proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock p. m. on the 30th day of November, 1891, for all the labor and materials required for the cut stone work and brick work, iron and wood floor and roof construction, roof covering, approaches, etc., for the superstructure, ready for the interior finish of the United States Court House and Post Office, at Springfield, Missouri, in accordance with the drawings and specification, copies of which may be had at this office, or the office of the Superintendent at Springfield, Missouri. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in an envelope, sealed and marked, "Proposals for the Cut Stone Work and Brick Work, Iron and Wood Floor and Roof Construction, Roof Covering, Approaches, etc., for the Superstructure, etc., ready for the interior finish, for the United States Court House and Post Office at Springfield Missouri," and addressed to W. J. Edbrooke, Supervising Architect.

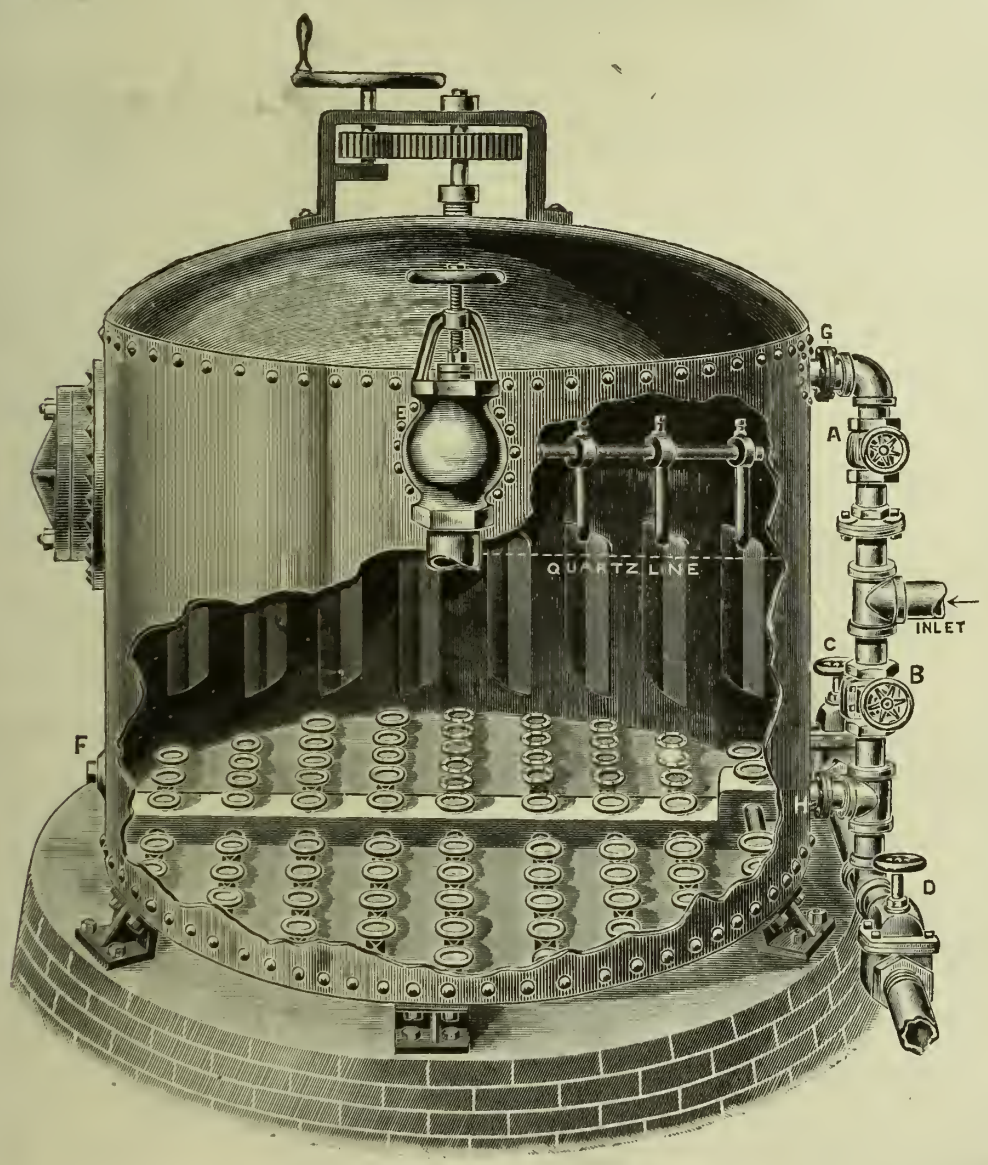
DECEMBER 5, 1891. The American Engineer. VOL. 22, NO. 23.

THE JEWELL PRESSURE FILTER.

The Jewell pressure system, as illustrated herewith, embodies many recent improvements of mechanism and is admirably adapted for purifying waters for boiler evaporation.

These filters are often placed between the feed pump and boiler, or heater if such is used, so that the feed water is pumped first through the filter, thus carrying the boiler pressure.

The O. H. Jewell Filter Co., of Chicago, have lately placed these filters in Armour & Co.'s grain elevators "C," "D," "E," and "F," all of which are used to purify the Chicago river water for boiler purposes. The river water after filtering is decidedly brilliant and crystalline, rivalling the water from mineral springs, and there is an advantage, in filtering the Chicago river water, of saving the expense of tax for lake water which often, in a short time, amounts to more than the entire cost of this apparatus. The filter medium does not require to



JEWELL PRESSURE FILTER.

be changed; the impurities being washed from it by simply reversing the flow of water.

These filters are made in sizes from 2 to 6 feet in diameter, with capacities from 15,000 to 125,000 gallons per 24 days. A battery of six of these filters, each 6 feet in diameter, are now being constructed for the water works at Lake Forest, Ill.

The Jewell improved filters are in extensive use and have now been upon the market sufficiently long to fully demonstrate their efficiency. They also make a system of gravity filtration. These filters are adapted for any class of work. The Jewell illustrated catalogue for 1892 is already issued, and will be sent to anyone wishing to investigate this important subject.

Mr. O. H. Jewell, the president of the company, is an engineer of unquestioned ability, having held the position of foreman of shops and master mechanic of the C., B. & Q., and C., M. & St. Paul Railways, and for many years he was chief engineer of the C., B. & Q. elevators. President Jewell is thus a thoroughly practical man, and he has given the mechanical construction of these filters his personal attention.

A NOVEL SMOKE BURNER.

Mr. Frank T. Robinson, of Chicago, has just perfected a novel smoke-consuming device, which, if all that is claimed for it is true, is certainly worthy of the consideration of those having steam boiler plants. Mr. Robinson has spent thousands of dollars and over five years' time in experimenting and studying the principles of smoke consuming. He made quite a success last year in tests made on some of the furnaces of the city, but, while the same principle was involved, he hadn't the fine means of regulation that he has since perfected. In fact, to use an expression of Mr. Andrew Young, ex-Smoke Inspector, regarding it, "it is practical, sensible, and scientific." The principle of the device, as Mr. Robinson explains it, is by means of small steam siphons placed immediately over the fire-doors, so as to discharge over the fire, with which are connected gas pipes running to the stack or a point just above the flues. By this means the escaping gas, or smoke, are caught, mixed with air and thrown back over the fire. The means of mixing the air with the carbonated gases, so as to revivify them, is the special feature that has occupied the inventor's mind. It is done in this way: Each siphon with a pipe carrying the hot gases at a temperature of from 500 to 700 degrees has a corresponding one receiving air. The two unite within the front liners, just before being discharged over the fire, so the mixture reaches the fire at a comparatively high temperature. The amount of air used is regulated by valves in the pipes, and by this means Mr. Robinson claims to manufacture a combustible gas out of the smoke. The device is regulated simply by the air valves and can be adjusted to any grade of coal or temperature of weather, and is so simple that the most careless fireman can understand and operate it. He claims that the suction at the stack creates an additional draft and equalizes the heat, making the boiler safer to use with the device on than off; also that it is perfectly noiseless when in use.

He has just organized the Robinson Siphon Burner company with a capital of $250,000, with offices at Room 809 Chamber of Commerce Building, Chicago, with Mr. A. L. Dickinson, one of Chicago's prominent and wealthy young business men, as Secretary and Treasurer, and proposes to manufacture and place his device on the market. The company controls United States and foreign patents and will place the attachment at a conservative price and sell it on trial to responsible firms.

UNIVERSITY EXTENSION FOR MECHANICS AND DRAUGHTSMEN.

The Philadelphia Association Local Center of University extension has decided to extend the work heretofore done to reach many of the men engaged in industrial establishments, and for the purpose has provided the following courses of instruction:

The course in mathematics which was given last winter is again being given to largely increased classes. This course consists of twelve lectures by Prof. Crawley and covers trigonometry and the use of logarithms. The examples used are largely taken from mechanics, showing the practical bearing of the work. Each lecture lasts one hour, after which the lecturer answers questions, solves problems and assigns the work to be done before the next lecture. The solution of the problems required are mailed to the lecturer during the week.

The course is to be followed by one on the mechanics of materials. The design of the course is to give the fundamental principles underlying the proportioning of parts to the load they are to carry. The lectures will be given under the following heads, the scope of the problems being indicated.

Lecture 1. Tension and compression, cylinder head bolts, boiler stays, connecting rods, boiler tubes, &c.
2. Shearing keys, riveted joints.
3. Bending, bending forces, moments of inertia.
4. Beams, size for a given load, load for a given size,
5. Torsion, shafting, engine and mill.
6. Combined stresses, boats loaded out of center, buckling.

These courses are in no sense popular or semi-popular, as to do the work successfully will require a large amount of individual effort.

It is the intention to provide such courses of instruction as will be of the greatest practical use to those taking them, and for the interest already exhibited in the proposed courses the society is encouraged to continue its work in this direction.

PRACTICAL SELF-SACRIFICE.

According to a report from La Porte, Ind., Dec. 1, the young women of that place dare to do (as well as talk). The Young Ladies' Charity Circle is composed of twenty-three society, musical, and dramatic young women of this city. The object of the society is the relief of the destitute and the afflicted. On the 8th of last August Ernest Schmitz, a poor lad, was burned by a gasoline explosion, since which time he has been under the care of the county physician. The sores have become so seated that it was decided that the only way to make them heal over was to introduce the process of skin-grafting, but did not know where to get the material. Hearing of the necessity, the young ladies of the "circle" promptly came forward and each one volunteered to give a portion of her cutis vera in the interest of humanity.

One of the interesting exhibits at the World's Fair from Montana will be a relief map of Butte, the greatest mining camp in the world. It is reported that Montana's appropriation of $50,000 will be doubled at the next session of the legislature.

A DESTRUCTIVE ELECTRIC BLAZE.

A disastrous fire occurred in Chicago Nov. 30, caused by the electric current being short circuited.

Two electric wires came in contact in the dynamo room of the Chicago Arc Light and Power company. In an instant there was a flash followed by a loud sputtering noise, and almost before the men at work in the room could escape it was in flames.

With wonderful rapidity the fire spread throughout the building, and in less than two hours it was completely gutted and much valuable machinery was ruined. According to the estimates of T. J. Smith, manager of the outside lamp system, Wylie McCoy, who built the engines, and Irving Flight, the night engineer, the losses on machinery will be about as follows:

Four 500 horse-power Williams' high speed compression engines	$40,000
One 250 horse-power engine	6,000
One Renolds' Corliss shifter	4,000
Twelve new upright 500 horse-power boilers	12,000
Three hundred lamps	15,000
Shafting, pulleys, touches	15,000
Sixty dynamos	240,000
Building	25,000
	$357,000

An insurance man estimated that the salvage on the machinery would be about one-half. He estimates that the loss on building and contents would amount to less than $200,000.

In the same building were a number of small manufacturing firms. Most of these were on the fourth and fifth floors, and their loss will be total. Nothing is left on the fourth and fifth floors.

The basement, first, second, and third stories were all occupied by the electric light company. In the basement were its boilers and engines; on the first floor were its valuable dynamos; on the second its shafting and pulleys, and on the third its stock of lamps and fixtures. Water and fire have almost totally destroyed all this stock, the dynamos especially being damaged. They are peculiarly susceptible to fire and water, and nothing but their iron frame-work will be of use again.

The building was purchased last January by the Arc Light and Power company, and has since then been entirely remodeled. It had a frontage of fifty feet on Washington street and 160 on the east side of the Chicago river.

The night force had scarcely settled down to work when the fire occurred. Four of the men were at work setting up a new dynamo and one was oiling the machinery. John Blake, watchman for the Central Manufacturing Block, which adjoined Arc Light and Power building to the south, had just entered the door, which blew shut with a bang. Then came the flash and the men fled for their lives.

"It was all done in a flash," said Watchman Blake. "As soon as the wires touched there was a flash. Then the sputtering fire ran along the wires until the whole room was aglow. No matter which way I looked there was fire. The rubber covering of the wires seemed to be burning, and as I ran out through the old dynamo room it was the same there, and from the appearance of things when I got out it was the same all over the building. The electricity seemed to run along the wires, and by the time I reached the alarm-box the fire seemed to have broken out in every separate room. Fortunately, as the men were leaving, Thomas Rallston, one of the night engineers, shut off the steam and the engines were stopped and the flow of electricity shut off."

A firewall saved the Central Manufacturing Block, which joined the electric plant to the east, so that the firemen had little trouble in keeping the fire confined to the building in which it started, but considerable damage was done by smoke and water in the Central Manufacturing Block, which is occupied by a score or more of manufacturing companies.

So sudden was the fire, and so instantaneous its spread, that the fifteen occupants of the building at the time barely escaped with their lives.

Engineer Thomas Rallston said: "I was working at my engine in the basement when there was a blinding flash and everything seemed to be on fire at once. I had barely time to shut off the engines and stop the current, and rush out. All my clothes are burned up."

I. Flight, the chief night engineer, said, when asked where the fire originated: "I don't think anything about it. I know where it started. I was there and saw it. It started from a short circuit in the conduit, which is on the ground at the north end of the court between the old and new buildings. Every wire on the circuit became red hot at once, and the woodwork at the bottom of the elevator caught from them. It was not ten minutes till the elevator shaft was a regular furnace."

The blaze was one of unusual fierceness. Added to the oily woodwork of the building were tons of paraffine for insulation and a roomful of cork. The cork added a new danger to the scene. As soon as the roof and fifth floor fell the blazing cork from the fourth floor shot up hundreds of feet in huge firebrands. These came down on the roofs of the adjoining buildings, and it looked for a time as if the whole district would be afire. The steamer Tioga was in the path of these firebrands, and had it not steamed a block further down the river another fire might have been added to the list.

The Chicago Arc Light and Power company furnished electricity for about 3,000 electric lights in various parts of Chicago, besides supplying power for electric motors. The stoppage of this supply of light and power will cause great inconvenience to the people of the city. The bridge-tender at Rush street bridge, which for the last few months has been swung by electricity, was about to swing his bridge to allow a vessel to go through at 7 o'clock when his current was cut off by the fire. The vessel was forced to wait until the steam turning gear could be gotten into working order.

The company supplied a large number of business houses and theaters with lights, and the burning of the plant left them in the dark. The electric signal lights on the Rock Island railway went out and had to be supplied with oil lamps. The lamps in front of the Grand Opera-House, Hooley's Theater, the Standard Theater, the Academy of Music, the Haymarket Theater, and the Lyceum Theater all went out. Fortunately the incandescent lights used within were supplied by another company, so that the audiences were not disturbed. The lights in a large number of business houses went out, and they had to resort to the use of gas.

THE ENGINE ROOM SUSPECTED.

The great fire from the electric wires at the Chicago Arc Light & Power Co.'s building Nov. 30 was followed by a big blaze at the Adams Express Building, Chicago, on the night of Dec. 1st.

Fire broke out in the basement of the big building at 11 o'clock p. m.

The Fort Wayne Electric Light company occupies the basement and the rear of the first floor. The boilers and coal bunkers are in the basement, the engines, dynamos, and switchboards being located on the ground floor. Where the fire broke out was doubtful. The engineer discovered it behind the switchboard, but it seemed to him to come from the boiler-room.

The firemen found great difficulty in locating the flames owing to the dense smoke that poured from the doors and windows. A hose was carried into the basement from the alley running between the building and the Fair, but one of the firemen was carried out insensible and his companions found it impossible to work longer in the suffocating air.

Lines of pipe were carried in from the front and streams turned on through the doors leading into the engine-room, but without appreciable effect. The smoke poured up through every opening, and the elevator shafts acted as a funnel to carry the smoke to the upper floors, giving the building the appearance of being on fire throughout.

Fireman Henry Callahan of Engine Company No. 32 was caught under an upturned dynamo. The heavy iron frame fell across his feet, and it required the efforts of a half a dozen firemen to rescue him from his perilous position.

Charles Slausen of Truck Company No. 1, living at No. 1043 West Harrison street, entered the basement under the Jenning's Trust company's office during the early part of the fire. Smoke was pouring up from the engine-room, and the fireman soon lost his way in the darkness. He fell on the floor and yelled for assistance. Two men attempted to reach him through the front entrance, but were driven back by the smoke. Finally a chain was formed by three firemen and a policeman and he was carried into the open air. He was taken to Hannah & Hogg's saloon near the Columbia Theater and, with the assistance of Dr. E. C. Fortner, was revived. He remained unconscious for forty minutes.

The amount of damage done by the fire is hard to estimate. The dynamos, switches, and engines of the Fort Wayne Electric company were ruined. The tenants will suffer great inconvenience, as the elevators will not be in running order for a week at least.

The Fort Wayne Electric Light company supplied power for 3,000 lights to business houses in the down-town district. The dynamos and switches being a total wreck, for some days there can be no power furnished those using the lamps. This coming on the heels of the burning of the Arc Light & Power company's property will leave a dearth of electric lights during the holiday season when they are most needed.

"It is a wonder, that fire has not broken out here oftener," said Watchman Daly, "for the place was so dry. I came here five years ago, and this is the third time it has burned. The last time the frame work became ignited from a red-hot pipe, and it may have been the same way tonight."

Chief Swenie said the fire started from the ignition of the pine floors over the boilers. He estimates the loss of $5,000 for the American Exchange Bank, $1,500 to the Adams Express company, and $5,000 for the Electric company. The chief engineer of the company places its loss at $15,000.

ANOTHER LOCOMOTIVE EXPLOSION.

Our correspondent at Akron, Ohio, sends us a full report of the terrible explosion of a locomotive, while running, on Friday morning of last week, on the C., A. & C. railroad, by which an engineer and fireman met their death without a moment's warning.

The explosion occurred at a point one mile west of the South Akron depot, just east of the canal bridge and at the entrance to the new B. & O. and C., A. & C. railroad yards.

Two trusted employes of the road, Engineer John Byron, of Millersburg, and Fireman George Parker, of Fair Oaks, in charge of Mogul 27, were instantly killed.

The wreck and explosion was the most complete and disastrous one in the history of the C., A. & C., and the oldest railroaders are unable to account for the cause. There are few instances on record where a locomotive has exploded while running, the majority of explosions to locomotives occurring while the engines are standing still.

The locomotive left the Akron round house about 7:30 in charge of the regular engineer and fireman and ran wild to Barberton backward. While at the point indicated the boiler head blew out and made a shapeless mass of the locomotive. The body of the engineer was found 600 feet south of the track and that of the fireman 200 on the opposite side.

Both men were married and Engineer Byron is the father of two small children. Engineer Byron was the younger and was thought to be about 30 years old by his fellow railroaders. Fireman Parker was several years older.

They claim that Mogul 27 was a comparatively new engine and was considered one of the safest on the road. No one knew how long it had been in use. A plate on the boiler bore the name of the builders with the date 1888. Whether this was the date when it was built or when it came from the repair shop could not be learned.

The Exposition Committee on Electricity has decided that the names of the following electricians shall appear over the entrances of the Electricity Building: Franklin, Galvani. Ampere, Faraday, Sturgeon, Ohm, Morse, Siemens, Davy, Volta, Henry, Oersted, Coulomb, Ronald, Page, Weber, Gilbert, Davenport, Soemmering, DonSilva, Arago, Daniell, Jacobi, Wheatstone, Gauss, Vail, Bain, DelaRive, Joule, Saussure, Cooke, Varley, Steinheil, Guericke, LaPlace, Channing, Priestly, Maxwell, Coxe, Theles, Cavendish. It was concluded best not to honor thus any electricians who are now living.

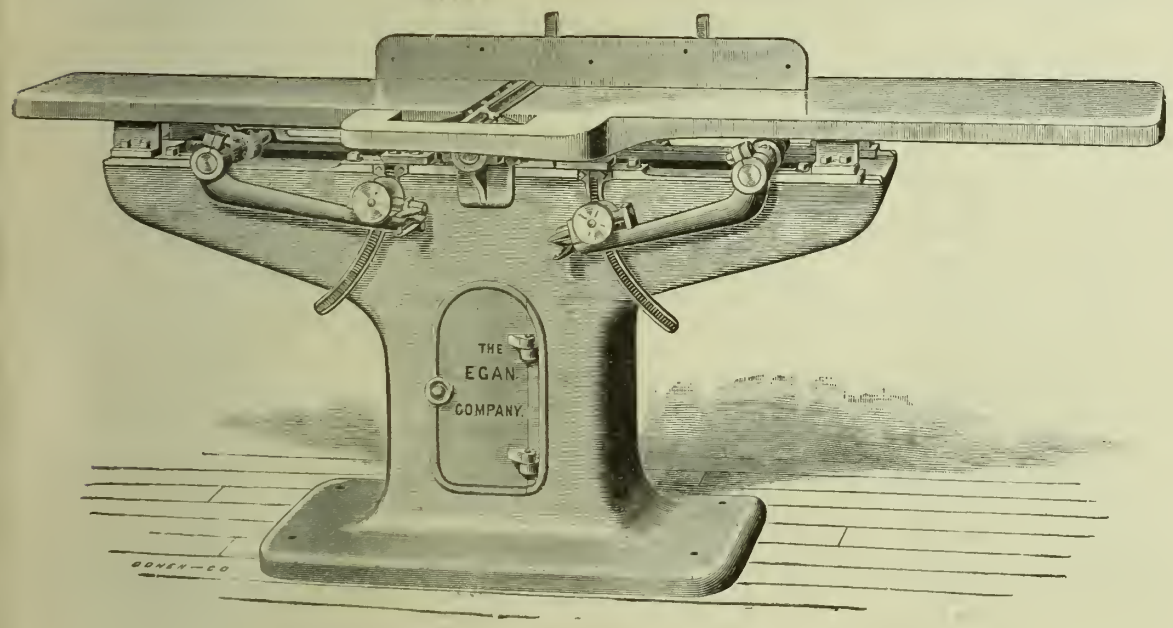
EGAN HAND PLANER AND JOINTER.

In these days of mechanical advancement there is brought out from time to time, special mechanisms for convenient and perfect work. One of these is to be seen in the engraving given herewith, which we have obtained from the famous Egan Co., of Cincinnati, O. The machine shown has a rabbetting attachment and slotted steel head, and through further courtesy are permitted to say of it as follows:

This new hand planer and joiner has special advantages not usually found on machines of this class and which will recommend it to practical wood-workers as being the most convenient machine made; doing a great variety of work, such as making glue joints (either concave or convex) planing out of wind, cornering, chamfering, beading, grooving, gaining rabbeting and a general run of work.

The column is one complete casting, cored out, using the inside for a tool box. The top is plained perfectly true, giving a solid and reliable foundation for the incline plate to work on. The journal boxes for the cylinder are also part of the main column insuring a steady running head.

The tables are over seven feet long, planed perfectly true having a rabbetting table connected which supports the stock, either for cutting across or with the grain of the wood, using the long straight knives for this purpose thereby saving time and money.



NEW HAND PLANER AND JOINTER.

The cylinder is made of solid hammered steel. Two sides are made plain to receive the long knives and the other two sides slotted for putting on beading, molding and any other shape of knife to suit the work to be done. This is a very convenient arrangement.

The patent bevel fence is very simple in construction. One clamp operated by a single screw will hold the same to any desired angle. The face is planed perfectly true and suitable provision is made for using the fence at any point across the table.

The new arrangement for raising and lowering each table independent of each other is very complete, The tables can be raised or lowered the fullest extreme, instantly, to give access to the knives, or they can be adjusted the smallest fractional part of an inch to suit the work, all of which is accomplished by the two levers placed convenient to the operator.

For further information, address the originators and builders, The Egan Company, Nos. 163 to 183 W. Front St., Cincinnati, Ohio.

The Council of the American Society of Mechanical Engineers has appointed a committee to devise and recommend a serious of efficiency tests of engineering appliances at the Columbian Exposition. On this committee are Chas. E. Emery, who was in charge of the steam boiler tests at the Centennial Exposition, and Prof. R. H. Thurston, of Cornell University, who was a commissioner to the Vienna Exposition of 1873, and a member of the jury of the Paris Exposition of 1889.

MECHANICS MADE EASY.

BY PROF. F. A. SMITH.

(*Continued.*)

In speaking of the specific properties of bodies, it is well to point out that there are properties which are in common to all solids but are not shared in by liquids and gasses, We will first look at the specific properties of solid bodies, and the most notable is called adhesion which may be explained as being a natural force which makes different small articles of one body cling to larger bodies. This explains why dust clings to everything it falls upon and is in fact a miniature gravity exerted by the larger body to the small particles. It is the force of adhesion which makes the cement, mortar and hundred appliances useful in the industrial world.

2. *Cohesion* is a force which holds the particles in a body together; that such a force exists is plainly evident, for if it did not there could be no distinction in bodies as gravity would mix everything together. The cohesion is strong in solid bodies, but only slight in fluids and less than the force of gravity; this explains why fluids can only be at rest when their surface is perfectly horizontal. In gaseous bodies the cohesion is totally absent and in its stead there is a repulsive force at work tending to separate the particles constantly.

The intensity of cohesion in solid bodies can be measured by the amount of resistance they offer to strains tending to rend them. Strains can be applied in two different directions; first, longitudinal either by applying weights or thrusts to crush the body or by a pull tending to tear it to pieces; the first strain is then called compression and if the body is fractured is called "crushed;" the second strain is called tension or stretching and the kind of fracture induced thereby is called tearing.

Forces can secondly be applied transversely and may be either bending or twisting; if the former, the strain is called bending and the fracture breaking, if the latter the strain is called torsion, and the fracture wrenching.

A body may also be subjected to a combined longitudinal and transverse stress at the same time; a force of this kind is called distortion, the strain induced detrusive, and the kind of fracture is called shearing.

Whenever such outside forces try to alter the shape of bodies they generate within the body an opposite force called elasticity which tends to restore the body to its original form as soon as the stress ceases to act. Up to a certain limit the elasticity of a body is exactly equal to the stress, and the elasticity up to such a point is called "perfect;" if this limit is passed then the bodies are at the mercy of the forces and brittle bodies will break; the forms of most bodies are changed permanently; for instance if a wire has been permanently lengthened by a great strain it will not be able to assume its original length but is still able to resist tension of a smaller force.

That elasticity is produced by stress can be poven by the ordinary pop gun; the air between the wad and the piston is compressed by the piston and as the pressure increases the elastic force of the air increases until the elasticity is sufficient to expell the ball.

Elasticity is most perfect in aeriform bodies and is also perfect in fluids. In solid bodies, however, it varies greatly. India rubber, ivory and glass, for instance, show considerable elasticity, while lead, clay, etc., have but little. If a ball of ivory is dropped upon a marble slab it will rebound nearly to the same height from whence it fell and if the slab had been covered with fine charcoal powder it would be found that the ball has taken up all the powder within a small circle; if the height of the fall be increased it will be found that the size of the circle also increases and this proves that as the ball strikes the marble plate it is compressed or flattened and the elasticity so induced causes it to rebound in the effort in regaining its original shape.

Flexibility should not be confounded with elasticity. Soft copper wire is very flexible but has little elasticity. Steel wire is both flexible and elastic, while threads of glass are very elastic but possess little flexibility.

Elasticity of the different bodies finds innumerable applications in the different industries and the application of steam, gas, steel springs, etc., must be credited to their elasticity.

The *ultimate strength* of a body is the intensity of the cohesion resisting a stress tending to produce fracture.

The *proof strength* equals the greatest strain that a certain body can bear with safety and varies from one-tenth to one half of the ultimate strength. The resistance which bodies offer to forces tending to pull their particles apart is called tenacity; in all other cases it is simply called resistance; if the stress is distortion the strength opposed is called resistance to shearing, etc.

A GREAT ELECTRIC RAILWAY COMPANY.

The International Electric railway company of Chicago, with offices at No. 260 South Clark street, that city, has just completed its organization. C. B. Holmes, late president and superintendent of the Chicago City company, has been elected President, Henry P. Daly Vice-President, W. S. Garvey Secretary and W. H. Applegate Treasurer. The Board of Directors consists of the officers and Geo. S. Knapp. This company was organized to build, equip, and promote the Applegate Underground Electric railway. The capital stock of $2,500,000 is divided into shares of $10 each.

The Applegate is an underground closed electric conduit system similar to the cable. Its main supply current wires are first covered with the best of insulation, then with a lead pipe. On this lead pipe at intervals of thirty-two feet are iron contact boxes. The lead pipe is soldered to the boxes and the solder substantially holds them in their place. Then an iron guiding rail is bolted to the conduit frame on which it tows all along a flexible steel bar thirty-three feet long, bolted to the guiding rail. The apparatus is propelled along by the car, running backward or forward, and making contact by coming between the boxes and guiding rail, thus giving the current to the motor on the car.

The current is entirely closed, air tight and water tight, only when acted upon by the car, and is not in the way of dirt or snow or any of nature's dissipating elements. The outside conduit is built chiefly of steel; with cast iron ribs of a peculiar design.

The company thinks it has just what is wanted in large cities for rapid transit, something reliable, perfectly safe, and rapid and powerful. The road can be run at a speed of from one to thirty miles an hour.

The company hopes to get permission to build and equip five miles of this road on the World's Fair grounds, making a circuit of the grounds and carrying passengers to and from the various main buildings. If it secures permission the road will be equipped with Pullman palace cars, and will be used also to make tests of the various electric motors to determine the advantages of each.

Mr. Sell, the London advertising agent, has applied for space at the World's Fair, to exhibit specimens of all of the leading newspapers of the world which have been printed during the last two centuries.

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CONTENTS OF THIS NUMBER.

PHILADELPHIA has an active auxiliary of the Daughters of Fulton, with Mrs. Minerva J. Hartzman as matron. Mrs. Hartzman is also Deputy Supreme Matron for the State of Pennsylvania. Her letter in this issue will no doubt be read with interest.

ELECTRICITY demands considerable attention in our present issue. The rules for regulating the Department of Electricity at the World's Fair are published. Two big fires are also reported—one in a new building occupied by the Chicago Arc Light & Power Co., caused by a short-circuit, and was unquestionably an electric blaze; the other occurred in the Adams Express Building, Chicago, part of the basement of which was occupied by the Fort Wayne Electric Light Company. But the fire in the latter place is supposed to have originated in the wood work over the engine room. And although the "wires" are not suspected in the latter case, the result is disastrous to those who obtained their electric current from that quarter inasmuch as the supply is extinguished by the destruction of the dynamos.

MECHANICS stand forth conspicuously in our present number. Prof. Smith continues his "Mechanics made easy." Then comes "The Doctor" with his first chapter on "Mechanical power," dilating upon the lever. The term *mechanics* takes in the action of forces on all "bodies," including solids, liquids, and gases, and thus affords sufficient topics for our two special writers. "The Doctor" proceeds to business, as may be noticed, without much circumlocution, and treats of the lever for a start. Between the two, who write quite independently of each other, it may reasonably be expected that "mechanics" will really be made easy, and readily understood by everyone interested therein. Formerly it was the mechanics who made gods, heros and kings, according to Shakespeare. Our mechanics of to-day make machinery and useful devices. Our steam engineers should all be well versed in mechanics. And we hope Prof. Smith and "The Doctor" will make the laws of forces better understood.

A WHILOM STATIONARY ENGINEER MADE CONSUL AT BERMUDA.

On Nov. 25 President Harrison appointed William K. Sullivan, of Illinois, to be United States Consul at Bermuda. This appointment will touch a chord of sympathetic pride in the heart of many of our readers, inasmuch as the Hon. W. K. Sullivan was at one time a stationary engineer in West Virginia. According to public records, his "pedigree" is as follows:—

William K. Sullivan was born at Waterford, Ireland, Nov. 10, 1843. He was educated in the national schools of Ireland, and later graduated from Marlborough Street Training School, Dublin. He came to the United States in 1863. After a brief sojourn in New York he migrated to Kane County, Ill., and in 1864 enlisted in the One Hundred and Forty-first Illinois Volunteers, serving six months. Returning to Illinois he taught school for a time near Bristol, Kendall County. Later he moved to the oil regions of West Virginia, where for a time he acted as a stationary engineer. After a brief visit to Ireland he returned to New York and commenced his newspaper career on the *New York Sun*. He was later employed as editoral writer on the *Chicago Tribune* and while so employed was elected a member of the Twenty-seventh General Assembly of Illinois, serving two years. Mr. Sullivan was appointed city editor of the *Chicago Evening Journal* in 1874 and later became managing editor. Mayor Colvin appointed Mr. Sullivan a member of the Chicago Board of Education, of which body he was twice elected President. Mr. Sullivan has been in poor health for a year past. He paid a visit to Ireland during the last summer, and upon his return to Chicago resigned the editorship of the *Evening Journal*. He still retains the Presidency of the company and his financial interests. For some weeks past he has been at West Baden Springs, Ind., whence he will return to Chicago and leave with his family for the Bermudas in a few days. Mr. Sullivan in 1874 married Miss Amelia Shackelford. They have had three children, two of whom are living—Helen Amelia and William. The present Consul of the United States at Bermuda is a son of ex-Judge Corydon Beckwith, deceased, having been appointed by President Cleveland.

STEAM ENGINEERING IN THE NAVY.

The annual report of Commodore Melville, chief of the Bureau of Steam Engineering, submitted to the Secretary of the U. S. Navy, is an interesting document. After detailing the work accomplished during the last fiscal year, and the condition of the machinery of the vessels of the navy, the report touches upon the needs of the various navy-yards. By far the most important feature of the report is Commodore Melville's statement referring to the personnel of the engineer corps. He says:

"It is with regret that I am again compelled to report that the number of engineer officers is insufficient for the proper performance of the duties belonging to them and to emphasize the fact that, unless measures are at once taken to remedy this condition and to stop the steady decrease in numbers, we shall before long have a painful awakening by a serious break down or accident on some of our vessels. There is a limit to even a naval engineer's endurance; and while the officers of the engineer corps will do their best to make all needful repairs and keep in efficient condition the magnificent machinery of the new vessels, from which the country justly expects so much and in which it takes a proper pride, they can go no further than the limit of their physical strength; when this has been reached the machinery must take care of itself."

MECHANICAL POWER.

By "THE DOCTOR."

There are probably many readers of THE AMERICAN ENGINEER to whom a series of articles on the principles of mechanics may be helpful, especially if written without algebraic nor geometrical signs, but expressed in plain figures so that anyone may be able to understand and use the formulas whose knowledge of mathematics is limited to arithmetic. In these articles (hereby commenced) the writer will endeavor to be clearly understood; and if anyone wishes further enlightenment on any point, let him say so, and we will do our best to accommodate him.

Let us commence with the three principles of the lever. A knowledge of these principles, when understood by the working engineer, in charge of a steam plant, will enable him to safely adjust the safety valve without seeking the aid of "the shop," nor calling in the so-called "expert."

THE LEVER.

In the first principle of the lever, the power is at one end, the resistance at the other, and the fulcrum somewhere between them.

The part of the lever between the resistance and the fulcrum, may be called the short arm; and that part between the fulcrum and the power may be called the long arm.

Rule.—Multiply the long arm by the power, and divide the product by the length of the short arm, the quotient will show the resistance overcome.

Example 1.—The long arm is 5 feet, with a power of 60 pounds applied, the short arm is 1.5 feet or one and a half feet.

The long arm 5 feet.
Multiply by the power 60 pounds.

Divide by short arm 1.5 / 300

Answer. 200 resistance overcome.

Or if decimals are not understood, the inches in the feet of the problem may be used. In this example we call the 5 feet 60 inches and the 1½ feet 18 inches. The problem can be demonstrated as follows:

The long arm 60 inches.
Multiply by power 60 pounds.

Divide by short arm 18 inches / 3600 / 200 resistance overcome.
36

000

Example 2.—The long arm is 6 feet, the power applied is 200 pounds. What resistance will the power overcome, the short arm being .75 of a foot, or 9 inches?

The long arm 6 feet.
Multiply by power 200 pounds.

Divide by short arm. 75 / 1200

Answer. 1600 resistance.

The long arm, the resistance, and the power given, to find the short arm.

Rule.—Multiply the resistance by the short arm, and divide the product by the power, the qnotient is the long arm.

Example 1.—The long arm is 18 inches, the power is 4 pounds, the resistance to be overcome is 32 pounds; what is the short arm?

The long arm 8 inches.
Multiply by power 4 pounds.

Divide by resistance 32 / 32

Answer. 1 in. the short arm.

Example 2.—The long arm is 7 inches, power 2½ pounds, the resistance 35 pounds; what is length of short arm?

Long arm 7 inches.
Power 2.5

Divide by resistance 35 lbs. / 17.5

Answer. 5 inches, length of short arm.

The short arm, resistance and power given, to find long arm.

Rule.—Multiply resistance by short arm, and divide product by power, the quotient is the long arm.

Example 1.—Resistance 1,500 pounds, short arm 9 inches, power 150 pounds; what is the long arm?

Resistance 1,500 pounds.
Short arm .75 of a foot.

7500
10500

Divide by power, 150 lbs. / 1125.00 / 7.5 length of long arm.
1050

75.0
75.0

Example 2.—Resistance 3,000 pounds, short arm 6 inches, power 200 pounds; what is length of long arm?

Resistance 3000 pounds.
Multiply by short arm .5 of a foot—6 in

Divide by power 200 lbs. / 1500.0

Answer. 7.5 that is: length of short arm 7 feet 6 inches.

The resistance, short arm and long arm given, to find the power.

Rule.—Multiply the resistance by the short arm, divide the product by the long arm; the quotient will be the power required.

Example 1.—Resistance 200 pounds, short arm 5 feet, the long arm 8 feet; what is the power?

Resistance 200 pounds.
Multiply by short arm 5 feet.

Divide by long arm 8 / 1000

Answer. 125 lbs. power required.

Example 2.—Resistance 125 pounds, short arm 7 inches, long arm 20 feet or 240 inches, required the power.

Resistance 125 pounds.
Short arm 7 inches.

Divide by long arm—in. 240 / 875 / 3.64 + or 3 ft. 7¼ inches.
720

155.0
144.0

1100
960

140

In the next issue, we will take up the second principle of the lever.

A subscriber enquires: Is pressure power?

Velocity is not power. Power is pressure and velocity combined. Power is not stationary, but a moving force. If weight is resting on the surface of the earth, it is exerting pressure, but not power—because it has no motion. If, however, a similar weight is falling, it has no power through its motion.

HOWLAND'S BRIDGE-GATE INVENTION.

G. B. Howland of Pontiac, Ill., is in Chicago with a simple contrivance for bridge gates which seems to furnish a solution of the troublesome question. His invention consists of two or three parallel metal bars, running the entire width of the street, which are raised and lowered in grooved pillars at each side of the street by means of a cable attached to a trolley running on a track at the top of each end of the bridge. When the bridge is closed this trolley rests on the top of the incline, but as soon as the bridge is swung the trolley runs down the incline, lengthening the cable and lowering the bars across the street at each end of the bridge. The contrivance has the feature of simplicity and cheapness in its favor. It does away with the necessity of tearing up the street and putting complicated machinery underground. Nearly all contrivances provide for the swinging of heavy gates which are almost as dangerous to traffic as the open draw, and with these, if the gate should strike a team the bridge would be prevented from swinging. With Mr. Howland's invention, however, the cross-bars are lowered slowly by their own weight, which would not be sufficient to do any damage. Interference with the gates will not have any effect on the motion of the bridge. Mr. Howland supplements these gates with a light barrier which can be dropped across each track of the bridge after the bell rings and before the bridge starts to swing by a single motion of a lever in the hands of the bridgetender.

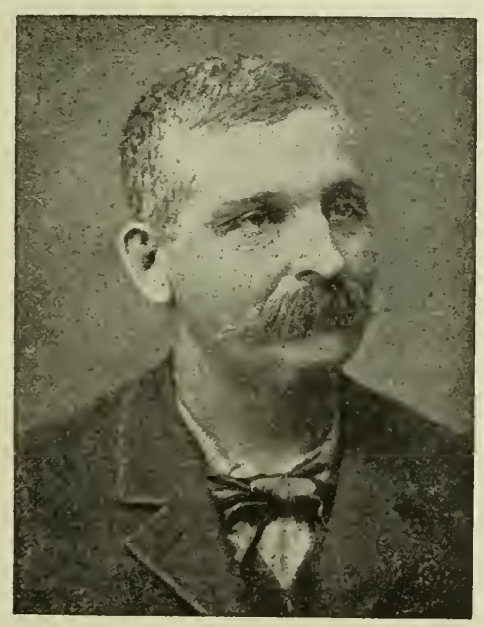
OUR FRIENDS.

V.—BENJAMIN P. KANE.

When a man has lived on this earth fifty-eight years he knows something of the ways of the world, as well as of the science of living, and it is about time for him to be master of his adopted profession—if he has capacity to observe and to learn. Bro. Benjamin P. Kane, chief engineer of the Jefferson Young, Jr. Council (A. O. of S. E.), Buffalo, N. Y., has reached that mature age, and has gathered in a great harvest of valuable information. And he puts his knowledge into good practice.

Mr. Kane, whose portrait we present herewith, was born on the 22nd day of January, 1833, at a place named Batavia, in Geneva County, State of New York. He went to the Union School until he was 12 years of age, at which time his father died, leaving the mother with five children to bring up—four girls and one boy.

Benjamin was the boy; and, to help getting a living, he worked at "odd jobs" two years. For the next two years he worked about the roundhouse of the Erie railway, and when about seventeen years old he went to work fireing a locomotive, and continued as fireman for a year. Then he worked a year in the Susquehanna Shop, and afterwards got promoted (by the Erie company) to run a locomotive, 18×20, 32 tons.



BENJAMIN P. KANE.

After the war, and when railroad business, like every other industry, was rapidly increasing, there was a scarcity of competent engineers. In 1865 new engines were put on the Erie lines every week, sometimes four, sometimes one, and occasionally two or three new ones. By special order of H. G. Brooks, Supterintendent of motive power, Bro. Kane had to run all new engines, to break them in, so to speak, or, more correctly stated, to see that they worked all right before being entrusted to less reliable hands.

After trying them, Engineer Kane delivered one after the other at Hornellsville, with a report of their condition. He was Engineer on the Erie lines twenty-one years; then two years on the Lake Shore road, running all sizes of locomotives, both passenger and freight, with cylinders from 18×20 to 20×24 inches, and some of them weighing 70 tons. And every one that he ever ran had a first-class reputation. Every officer he worked under had nothing but words of praise for "Ben"

Mr. Kane went to Buffalo, N. Y., in 1879, and put in a steam plant in a fruit canning establishment, which he operated one year. He then went to the Buffalo Fertilizer Works, where he stayed two years, and had charge of four 14×48, or 50 horse-power (capacity) boilers, and one engine 14×26, as well as one 12×20, both run on one line shaft. Mr. Kane found one of the engines "lowered up with old lumber and scrap" and supposed to be good for nothing.

He resurrected her and put her in shape. When he started her up he was warmly complimented by the builder of the engine, who said to the president of the company, "You have an engineer, Mr. Crocker, who is getting 80 horse-power work out of a 50 horse-power engine."

Since then Mr. Kane has set up three and has had marked success with them all. He worked for Richmond and Co., lithographers, over five years. During that time it is a remarkable fact that he was never five minutes late in starting up.

Richmond & Co., subsequently leased a building for which steam power was supplied, so they had to part with their engineer. And Mr. Kane prides himself on the fact that he is the first and only employe who ever received a testimonial from the firm signed by the Hon. H. A. Richmond.

Mr. Kane took charge of his present plant November 17, 1888, that is over three years ago. "Everything is left to him," and the only order he ever had from Mr. Hutchinson was when the first boiler was dropped on the street—he said, "Kane, take charge." He operates two steel boilers 12×48, and a 50 h. p. engine (Tifft) with a No. 4 Otis heater. Mr. Kane selected everything in the plant, and has full charge of everything, from cellar to garret, connected with steam or water, and "the governor will back him in any shape or manner" says are intimate friend of his.

In the articles of association and by-laws of the Howard Dime Savings and Loan Association, of Buffalo, the name of Benjamin P. Kane appears as president. This in itself, shows him to be a provident man. But he has not hoarded up a pile of money from his savings. He is of a liberal disposition, and has proved the proposition to be true that it is better to give than to receive. He has been an Odd fellow for over 20 years, but he has never received anything from that nor any other society—never needed any monetary help.

Mr. Kane is not a man of property, but "his credit is good for any amount among the business men of Buffalo." He is a thorough American from "way back"—200 years or more. His parents were born in Connecticut, his father being of Spanish descent, while his mother's ancestors came from Germany. But for 200 years, as already intimated, the dust of of the lineage has been American.

The accompanying portrait conveys a fair idea of Mr. Kane's facial characteristics. He is 6 feet 2 inches tall and weighs 230 lbs. He always "helps the boys out," and he is said to have put more men in positions than any other half dozen engineers in Buffalo. He always "stays" with his friends, and is ever ready to extend a helping hand to a needy brother. His friendship extends to the best locomotive and stationary engineers in that part of the country. He is quite popular with "the boys."

As we stated, in a recent issue, Mr. Kane is likely to be appointed chief inspector of stationary engineers in the City of Buffalo, as soon as their licensing ordinance becomes law. For that position he has been strongly recommended by all his employers (since he was 17 years of age), and by a great number of his brother engineers as well as many business men in the city of his adoption.

TO PREVENT RUST ON IRON.

A French chemist, says the *Philadelphia Record*, has discovered a new process for coating castiron vessels with a film of magnetic oxide of iron, so that exposure of the articles to the atmosphere for considerable time shows not a sign of rust. The process consists in depositing by galvanic means a metal or metallic alloy which is susceptible of volatilization at a temperature of about 1,000°. After receiving this coating the articles are subject to a heat of 1,000° or more, according to the required amount to cause the volatilization of the metallic deposit. The formation of the magnetic oxides by this process is spontaneous, being perfectly adhesive and uniform.

WHO WILL BE THE WINNERS?

THE AMERICAN ENGINEER Publishing Co., with the view of bringing up the circulation of the paper to fully 20,000 copies each issue, offer a premium of $40 to the one who will send in the greatest number of new subscriptions, $20 to the one who will send the second greatest number, and $10 to the one who sends the third greatest number of new subscriptions, by January 1, 1892.

ELECTRICITY DEPARTMENT RULES.

The following rules have been issued, approved by Director General Davis, for the government of exhibiters in the Department of Electricity, at the Columbian Exposition:--

1.—Applicants for space in this department are requested to furnish the following information as near as possible:

A drawing to the scale of one-quarter inch to the foot, showing size of space desired and general distribution of articles to be exhibited; also aisles, if any, among exhibits. Express length, breadth, etc., in feet and inches.

State whether current for motors, lamps, or other devices is required, specifying quantity and potential in volts and amperes.

If power for operating machinery is required state number of horse power wanted.

The above information is absolutely necessary for the proper allotment of space.

2.—Applicants accepting space must agree to occupy it in accordance with the rules and regulations, except when special arrangements are made in writing with the chief of the department, and are requested to give earliest possible notice if they decide not to exhibit. Whatever exhibits will admit the exhibiter is requested to display in glass cases.

3.—No exhibiter can exhibit in any other than his own space without obtaining the written permission to do so from the chief of the department.

4.—No exhibitor will be allowed to arrange his exhibit in any way to occasion inconvenience or affect the display of other exhibiters. The chief of the department reserves the right to order any change in the design or arrangement of exhibits in the interest of harmony or the protection of other exhibiters.

5.—The floor of the Electrical Building is designed to sustain a weight of 150 pounds per square foot. Any exhibit requiring an extra support, in the judgment of the chief of the department, must be furnished with satisfactory support or foundation at exhibiter's expense.

6.—All exhibits of dynamos and dynamical current generating apparatus intended for operating, with full or more than a very small percentage of their full capacity, will be located in Machinery Hall, and will be placed in practical operation for transmitting current to the Exposition Building. Applicants for space desiring to offer their exhibit of dynamos and generators, etc., for the service of the Exposition for lighting the grounds and buildings for artistic effects, or for furnishing power to the various departments, should communicate with the Director-General or Chief of the Department of Electricity as early as possible.

7.—All platforms, railings, counters, signs, partitions and show cases must be erected at exhibiter's expense and shall not exceed dimensions given below. All designs for the above with location of same in exhibiter's space must be submitted to the chief of the department for his written approval before installation is begun. Show cases shall not be higher than fifteen feet above the floor of the main aisles. Railings may be erected, but must be of a uniform height of two feet six inches and subject to the approval of the chief as in Rule 8. Platforms will be allowed only in certain parts of the building. All exhibiters wishing platforms to cover their space must build them to a uniform height of eight inches. Partitions will be allowed only in certain parts of the building, and in all cases must not exceed fifteen feet in height, and must be approved in writing by the chief of the department before their erection is begun. Signs must be ornamental in character, and designs for the same must be submitted to the chief of the department for his written approval. No sign will be to extend beyond the limits of exhibiter's space, nor will signs of muslin, linen, canvas, or paper be accepted. The chief of the department will have the right to order down any signs that may be in an objectionable location or may disadvantageously affect the appearance of the general exhibit.

8.—All exhibits of machinery in motion must be protected by ornamental railings of a uniform height of two feet six inches, and all designs for railings must be submitted to the chief of the department for his written approval.

9.—No fire will be allowed in the Electrical Building except by the written permission of the chief of the department; oils and inflammable material will be allowed only in quantities sufficient for day's use; suitable storage will be provided for the same.

10.—Exhibiters requiring power in the Electrical Building will have to furnish the necessary counter-shafting, pulleys, hangers, etc., at their own expense. Electric motors only will be allowed for moving machinery in this building and must be furnished at the expense of the exhibiter. Shafting and motors will be under the care of the exhibiters requiring them, but can be erected only on receipt of a permit from the chief of the department. Exhibiters must arrange their exhibits in such a manner as to require a minimum of shafting by using motors connected or bolted to their machinery direct.

11.—Exhibiters may employ watchmen to take care of their machinery and exhibit at night, but such watchmen will be subject to the approval of the chief of the department.

12.—The distribution of cards, circulars, pamphlets, or supplies about the building or its vicinity will not be permitted under any circumstances. Exhibiters can distribute such articles only from their own space, but will not be allowed to solicit their acceptance.

14.—The arrangements and erection of electric conductors in all parts of the building shall be wholly under the supervision of the chief of the department, whose directions must be followed and whose decisions shall be final.

15.—Exhibiters will be required to attach to each exhibit a printed or typewritten description in the English language of the use and operation of the object exhibited for the information of the public.

16.—Exhibiters or their agents will be furnished by the department with duplicate cards upon which must be the name or description and the catalogue number of each article entered for exhibition. These will be countersigned on receipt of articles into the Exposition. One of these cards shall be conspicuously attached to the article described and the other to be retained by the exhibiter to serve as his order for the article at the close of the Exposition.

AN INTERESTING EXPERIMENT.

A simple and interesting experiment enables one to trace sound vibrations in a glass of water. Take a fine, thin glass, such as will give forth a musical sound if rubbed with wet fingers around the rim. Fill it nearly full of water, and, having wiped the edges dry and smooth, place upon the rim a cross made of two equal strips of thin cardboard (an old postal card will do for the material), with the four ends bent down at right angles, so as to prevent its slipping off.

Now, if you gently rub the outside surface of the glass with a wet finger it will sing or give forth a sonorous musical note. But the principal phenomenon that you are to observe in this experiment is the following: If your finger rubs the glass below one of the ends of the cardboard strips the cross will not stir; but if, on the contrary, you rub any other part of the glass, not in a perpendicular line, with one of the four ends of the cross, this latter will gently turn of its own accord until the end of the cardboard arms of the cross arrives at a point directly above the point where you are rubbing with your finger.

Thus, by placing your whole forefinger around the middle of the glass, you can make the cross turn at will, as if by magic, without touching it at all.

This experiment demonstrates the existence of what are called, in the science of acoustics, the nodes or knots of vibration in sonorous bodies. These nodes are the four points on the rim of the glass at which the arms of the cross stop. The spaces between these points is where the sound vibration is the strongest, and where, consequently, the branches of the cardboard cross cannot rest.—*Philadelphia Times.*

Leigh Lynch has been commissioned by Director-General Davis to visit the South Sea Islands in the interests of the Columbian Exposition.

A NEW WORKING MEN'S CLUB.

The Steel Works club of Joliet, Ill., composed exclusively of employes of the Illinois Steel company, will hold its second annual meeting and demonstration at its club-house this (Saturday) afternoon.

There are few instances where great corporations have shown as much consideration for the welfare of their employes as has this company in the establishment and maintenance of the magnificent club-house.

The Lorillards, tobacconists, have established a library for their female employes only; Carnegie, the Iron Prince, and the managers of the Brooks Locomotive Works have opened libraries for their employes, but none of these firms has been as enterprising and original as the Illinois Steel company. It bought the ground, built a splendid club-house, and donated it to the use of its employes. It keeps up the repairs, pays the taxes, the costs of superintendency, and the salaries necessary to its maintenance.

The cost to employes becoming members is $2 a year. There is no initiation fee.

It is more than a club-house. Five trustees, elected by the company, represent it in all matters pertaining to the club. While the members manage the institution the trustees hold the right to veto measures they think will divest the property from its legitimate use. The working rules are few. They forbid on the premises the use of any intoxicants, betting or gambling, and religious or political meetings. The expenditure of the dues and income from lectures, classes, and other sources rests with the directors elected by the members.

The club has now 1,200 members, all men or boys in the employ of the company.

In the club-house were a gymnasium, bowling alley, handball court, billiard rooms, game room for chess, etc., bath rooms, library with 2,000 volumes, all current periodicals, daily papers from all great cities, art rooms with a valuable collection, reception room for social gatherings, assembly hall provided with pianos for musical events and well adapted to lectures and classes. The library will be increased by the trustees to 4,000 volumes. It has an average circulation of 600 volumes a month. There is another novel feature. The members vote what books they want and, if the works are not of a character at variance with the objects of the club, they are at once purchased.

An educational department is conducted for children of employes as well as members. Classes have been taught the last year in arithmetic, shorthand, drawing, gymnastics, bookkeeping, reading, sewing, German, mechanical drawing, penmanship, kindergarten. The teachers are high class, and 381 students were enrolled. Two hundred new members came in last year. The families of members are admitted to all entertainments.

There is not another institution like this one in the world. The idea of this club originated with the directors of the Joliet Steel company, and the cash for building was appropriated for the work, before the consolidation took place and formed the Illinois Steel company. The directors of this new company liked the idea. They amplified it. The first annual meeting was held Dec. 21, 1890, the anniversary of the opening of the house, but it was found that this prevented many employes from enjoying the holidays by visiting friends, which they desired to do, and, out of consideration for them, the date this year was changed to Dec. 5. The company will charter a special train to take Chicago guests to the annual demonstration. The heads of other great corporations in the city, employing many thousands of people, will be invited to attend and witness the practical working of the enterprise in the hope that they may provide similar clubs for their people. Men and women who have a care for the intellectual and manual training of the working classes will also be asked to attend.

Besides the regular business meeting there will be brief addresses on inspection of the club-house, its appliances, and facilities, and a banquet. It will be a great afternoon for the promoters and beneficiaries of the Steel Works club.

Mild weather has followed the frost and snow around Lake Michigan, and elsewhere, and rain has descended without the aid of professional rain-makers.

CORRESPONDENCE.

Battle Creek Council No. (6), Mich.

Editor, American Engineer:

Our Council is steadily growing, and before long we expect to make large additions to our number. We have just succeeded in obtaining positions for two of our members this makes us feel good, and demonstrates to the boys that, outside of sociability, there are special advantages connected with being a member of such a good Order.

Yours Fraternally,
J. W. Robinson, C. E.
Battle Creek Council, Mich.

"Our Friends."

Editor, American Engineer:

The photograps published in the American Engineer, and the "pedigrees" of Our Friends gives all members of the A. O. of S. E., and others, a chance to know something about those whose names are familiar. I was extremely glad to see the picture of Bro. Jeremiah Leahey, Jr. I was imagining that his head must have had a big bump where his figures are thonght out; but I find his face and head to be in very good shape.

Mr. Leahey's tables (of the weights of water) must have taken him a long time to work out. At least I shonld think so. I was talking with a number of engineers recently about those tables and their anthor. And the more they talked about him the more they wondered at his ability and patience in working ont such figures:

"And still their wonder grew,
How one small head could carry all he knew,"

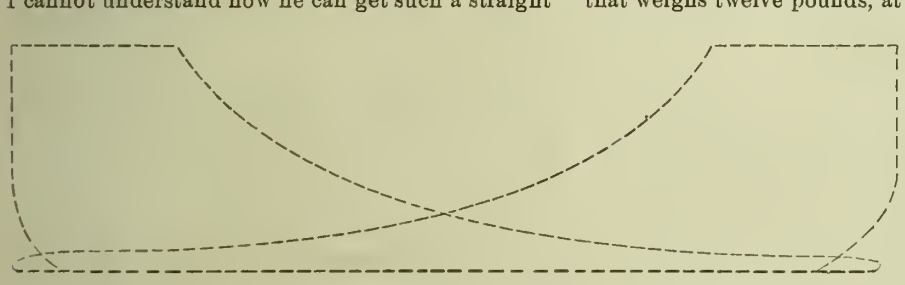
as Goldsmith said of the village schoolmaster.

One of Them.

The Card Figured Out.

Editor, American Engineer:

In your issue of November 14th is a card from "G. N." He says, it is an arc indicator he used. I cannot understand how he can get such a straight admission line with the arc indicator? It is a very good card; the cutoff is extra good; and the expansion is fine. But in the left-hand card the compression curve is not as high as it is in the right hand one, and looks to me as if there might be a small leak in the exhaust valve at that end of the cylinder. I have laid ont the left-hand card, and find the m. e. p. to be 28 lbs and $^{24}/_{100}$; this gives net horse power of 62 and $^{9513}/_{10000}$, at the speed given, 360 feet of piston per minute.



The Arc Indicator Card.

"G. N." says he wishes some one would figure out its details. Hoping that I have fully complied with his request, I remain, yours truly,

Jerry Leahey, Jr.

SOLDERED HIS EYELIDS TOGETHER.

A Bangor plumber met wit a very peculiar accident while at work on the west side one morning recently. He was using some solder in a gutter and did not notice that there was a little water in it. The moment he applied the melted metal it snapped and flew. One piece of it came directly for his eye and the lids closed involuntarily as the solder struck. They closed the moment of contact, and as it rested upon the lashes it soldered the lids togother so firmly that it was impossible to move them. The eye was not injured in the slightest, but it was effectually closed. The victim was half amused at the ridiculous side of the affair, and wanted to go to a barber and have the eye cut open, but a companion took him to Dr. Edmunds, who severed the lashes and removed the metal fastening so that the plumber is now using both eyes again. But there are no lashes left to intercept the next flight of hot solder.—*Boston Commercial.*

FLYING MACHINES WHICH PROMISE SUCCESS.

At a meeting of the Aeronautical Society of Great Britain, which was held yesterday, Mr. Maxim, the inventor of the Maxim gun, explained the progress he had made with his experiment in aerial navigation. He had already spent £10,000 in experiments and had arrived at such important results that he had come to regard it as certain that in the near future he would achieve success. E. F. Frost gave a detailed description of a flying machine in the construction of which he had been engaged for years. After much study of the structure of birds he had produced one made of feathers, one of the wings of which, although weighing only a few ounces, was twelve feet long. Sir James Donglas described some of the results achieved by Mr. Maxim as most astounding, showing the practicability of aerial navigation which he had little doubt Mr. Maxim was prepared to spend £10,000 more upon further experiments.

A SAMSONITESS.

According to a Leipsic letter to the St. Louis *Post Dispatch*, there is a female Hercules, or Samson, in Germany. She is a Strasburg girl.

The audiences of the variety theater of the Crystal Palace of Leipsic, from whose stage many prime curiosities have been promoted to wealth and affluence by emigrating to the dime museums of the United States, are all agog at the present time over a female athlete, Miss Victorina.

Miss Victorina is a handsome woman, tall, muscular, and very graceful withal in the various exploits in which she exhibits her wonderful bodily strength. To lift hundreds of pounds of weight with one hand is child's play to her. She tears, bursts, and cuts in two iron chains with links one-quarter inch in thickness, and stops the progress of a cannon ball by catching the missile in her hand, thus robbing it of its trajectory force.

This wonderful feat of catching a cannon ball that weighs twelve pounds, at a distance of ten feet from the mouth of the gun, is one of the most wonderful performances ever witnessed by anybody. Prowess and absolute certainty go in hand in hand with extraordinary strength. Loaded down with 624 lbs. gigantic balancing rod in her hands, and with heavy iron balls dangling from her body, Miss Victorina displays her almost supernatural strength to the very best advantage. To lift 100 pounds with her teeth is an easy task for the female Hercules. With one thrust of her arm she snaps asunder a strong iron chain like a thin piece of cord. This is done by the enormous tension which is given to the muscles of her upper arm. She also cuts in two with one blow of her powerful fist a chain stretched between two poles.

She closes each daily performance in the tableau of the ironclad Germania, her body encased in a steel armor and balancing on her shoulder the barrel of an enormous cannon.

Dust is present in steam and in air.

THE LAND OF "PRETTY SOON."

Sun, silence, and adobe—that is New Mexico in three words. If a fourth were to be added, it need be only to clinch the three. It is the Great American Mystery—the National Rip Van Winkle—the United States which is *not* United States. Here is the land of *poco tiempo*—the home of "Pretty Soon." Why hurry with the hurrying world? The "pretty soon" of New Spain is better than the Now! Now! of the haggard States. The opiate sun soothes to rest, the adobe is made to lean against, the hush of day-long noon would not be broken. Let us not hasten—*manana* will do. Better still, *pasado manana.*

New Mexico is the anomaly of the Republic. It is a century older to European civilization than the rest, and several centuries older still in a happier semi-civilization of its own. It had its little walled cities of stone before Columbus had graadparents-to-be; and it has them yet. The most incredible pioneering the world has ever seen overran it with the zeal of a prairie fire three hundred and fifty years ago; and the embers of that unparalleled blaze of exploration are not quite dead to-day. The most superhuman marches, the most awful privations, the most devoted heroism, the most unsleeping vigilance wrested this bare, brown land to the world; and having wrested it went to sleep. The winning was the wakefullest in history—the afternap eternal. It never has wakened—one does not know that it ever can. Nature herself does little but sleep here. A few semi-bustling American towns wart the Territorial map. It is pockmarked with cattle-ranches and mines, where Experience has wielded his costly birch over millionaire pupils from the East and the Continent. But the virus never reached the blood—the pits are only skin-deep. The Saxon excrescences are already asleep too. The cowboy is a broken idol. He no longer "shoots up the town," or riddles heels reluctant for the dance. His day is done; and so is that of the argonaut. They both are with us, but their lids are heavy. And around them is New Spain again, dreamy as ever after their rude but short-lived nudging—From "The Land of Poco Tiempo," by C. F. Lummis, in December (Christmas) *Scribner.*

WHAT THE IRON WILL COST.

Immense expense will be attached to the iron work necessary for the Administration Building of the Columbian Exposition. Bids for the work have been opened by the Chief of Construction, and it was shown that 10,000,000 pounds of iron would be required. The lowest bid for the work was submitted by the Edgemore Bridge company of Pennsylvania. This company asks 4 29-100 cents per pound, making a total of $429,000 for the iron work of the building. There will be more iron work in the Administration than in any other building. This is owing to the size of the immense dome which will surmount the structure and be made of iron.

The Civil Engineers' Club of Cleveland, listened to and discussed interesting papers at the last meeting Mr. E. P. Roberts read a paper on the The Powerhouse of the Broadway and Newbury Street R. R. Co., and Mr. Geo. E. Gifford read one on the Cleveland Rolling Mill Co.'s plant. The paper of the evening was by Prof. Frank H. Neff, entitled French Roads—their administration, construction, and maintenance. It contains an elaborate and detailed account of how these celebrated roads were constructed, their cost, the way in which they are kept in repair and the care and pains taken to maintain them in their present high state of excellence.

Mr. James Dredge, who accompanied Sir Henry Wood from Chicago to London has begun the publication of a series of Exposition articles in his paper, *Engineering*, the most welcome of our foreign exchanges, and the leading paper of its class in the world. These are technical in style and are accompanied by numerous plans, drawings, etc.

The World's Fair grand choruses and band concorts—the popular musical entertainments—will be held in an amphitheatre accommodating 15,000 people or more. This will be in the extreme southern part of the park and, after the close of the projected musical programme, will be transformed into a live-stock show ring.

THE WOMEN'S DEPARTMENT.

Philadelphia Auxiliary, D. of F.

Editress, American Engineer:

The Daughters of Fulton Auxiliary No. 1 of the A. O. of S. E., of Philadelphia Pa., was organized by Mrs. Julia Young (past supreme matron) on Monday evening Aug. 3, 91.

This auxiliary has had a hard struggle to keep upon its feet, but it is still progressing and we hope to make a success of this society; one thing favoring this auxiliary, is the fact they are all ready and willing workers, and feel proud of being of some use and help to the A. O. of S. E. of which they are a part, fully realizing that at any moment they may be of assistance to the unforunate engineers or that their families may need the help or comforting words of sympathy, which none can give so well as those bright, active and intellegent women of which The Daughters of Fulton is comprised. No hand is so soothing to the sick and wounded as a woman's, and when an engineer or his family meet with an accident or misfortune, none will be so ready and willing to give assistance, relief, and words of comfort, as these noble women.

An engineer is like a man who volunteers in war and faces cannon, shot and shell, knowing that at any instant death is liable to fall upon him, therefore every council of the A. O. of S. E. should feel and see the need of The Daughters of Fulton Auxiliary and do all in their power to build up the Order, talk it over with their wives and daughters and make them interested in the good work, and the making of a good society where they may learn and become more familiar with the incumbrance and difficulty that the husbands labor under in order to support their families, of the hot, dry heat they have to encounter in clearing fires, then in summer, the wife will have one cool place for the huband and father to sit, the little odd pieces work done and put aside from the sight of the tired and over heated husband when he returns from the engine room, after a long, hard day of bodily, as well as mental work which all engineers must have at all times, as they are the class of men who must think and act at the same time, and are really supposed to *know* without thinking.

The wife should visit the engine room and study the engine, as she does the engineer, for with him, she knows quickly enough when to use the safety valve, when they are going to blow off, for there is a certain amount of steam on hand, and they only have to keep an ear and eye on the safety, valve.

Yours in F. P. and R.

Mrs. Minerva J. Hartzman,
Matron of Aux. No. 1 Phila. Pa.
No. 4551 Mulberry St. Frankford Phila.

Inside and Outside of Us.

A pleasant talker named Miss Harrison has been lecturing at the Art Institute, Chicago, on subjects of interest to women.

Miss Harrison talks to mothers as follows:

"I am going to try to impress on your minds the fact that those things which we see outside of us are those which are inside of us. All our thoughts of things external have their corresponding existence inside of us.

"All the great writers realized this fact and spoke of it. Homer repeatedly writes of it and George Eliot is full of it. When the child shows his first sign of conscious intellect, as when the baby smiles into your face for the first time, it is the awakening in him of the law of recognition. It is an impossibility for any mind to take in an entirely and absolutely new fact. There must be some point of resemblance to some fact the mind has previously grasped.

"So few mothers realize that they can by means of external things mold their children's thoughts into whatever channel the mothers wish. The child's playthings are the avenue which guide his thoughts. So you can definitely furnish your child with thoughts and ideas which govern his actions and make him what he is. 'As a man thinketh in his heart, so is he,' and you mothers are concerned with the 'is.' Remember that your child hears you continuously criticising him or other people the first thing you know, he disagreeably surprises you by harshly criticising you or his father.

"Or if he hears you constantly telling falsehoods, little white lies, or greatly exagerating facts, he will unconsciously do likewise. So, also, if you talk to your children constantly of the commonplace things you turn their thoughts that way, and of course their actions. So I say to you that by means of such simple things as these little blocks you can lead your children's thoughts in whatever channel you like."

Following her talk Miss Harrison gave the mothers a practical lesson with numerous illustrations of games which could be played with the blocks, and of how to teach the child to illustrate his games and thoughts by means of them.

Women Still Advancing.

Among the crowds that entered Oklahama when a pistol shot proclaimed that the new lands were open to settlement, were a twenty-one-year-old girl who had walked fifteen miles to the border, a negro woman who had walked twenty miles with a baby in her arms and led a six-year-old child, three women on horse back with children strapped behind them, and a woman sixty-five years old on horse back. This Oklahoma incident is only one indication of the steady advance woman is making toward an independent position in the life and work of the world. She conquered the professions long ago, and woman lawyers, physicians, preachers, and editors are no longer a rarity. Her right to have as good an education as her brother is also conceded, and that she is taking advantage of it is seen in the constantly increasing classes at girls' normal school and female colleges. One of the latter in Massachusetts has an entering class of 241, where sixteen years ago the class numbered only twelve. Probably every female college and seminary can show a similar growth in its classes. The demand for increased educational facilities for women is not peculiar to this country. It is seen in England and France as well as here. The encouraging fact in this latter advance of woman is that it is directed more toward the practical and not so much toward the theoretical. The demand for the ballot is no longer the one avenue along which women are directing their greatest efforts for place and position. They have found other ways. If woman can prove her fitness and inclination to make her own living in the world, she will gain a new independen y in making a matrimonial choice, and more women will contemplate with serenity the chance they have of marrying.

Marriage will be looked upon as less of a necessity, there will be more deliberateness in choosing and consequently fewer unhappy marriages will result. There is no advance which woman can make which will benefit herself and society at large so much as a greater independence in marriage. And, whether she gains this independence by making horse-shoes, as Miss Alide Wilder has done in the suburbs of Brooklyn, or by taking the post of engineer on the boat of which her husband is captain on the lower Mississippi, or by managing a horse railroad, as Miss Dow did in Dover, N. H., or by presiding over the best arranged hotel on the Jersey Beach, or by joining the Oklahoma boomers—the great majority of men will applaud, provided, of course, that these occupations do not lesson the chief charms of female character. No one would wish to see that result, and natural laws may be trusted to prevent it.—*Philadelphia Press.*

In Buying a New Hat.

I like a new hat. I am still enough of a girl for that, and I like to see the girls in their pretty new hats; but I want to say this to them: Don't get a hat that is too fine for your frocks. Don't spend all your money in elaborate laces and plumes and jets, when a simple little turban made of cloth like your frock, or a block felt suited in shape to your face, and trimmed with a wing or two, or some loops of ribbon, will not only be becoming, but will stand the winter's wear, and, by being brushed often, look almost as good as new.—Mrs. Mallon, in *The Ladies' Home Journal.*

Twenty young women, skilled in the use of the microscope, have been employed by the government as pork inspectors at Kansas City.

The Stages in a Woman's Life.

The different steps in a Woman's life are depicted by "A Female Observer" in the New Orleans Picayeme as follows:—

A wee mother is carefully putting her favorite doll to bed. With tender solicitude she carefully removes each dainty garment and fastens on the tiny nightgown. Then, with a fond kiss, she hugs her treasure to her and places it in its little cradle. After patting it gently she tiptoes out of the room as the twilight peeps curiously in.

A fair maiden stands before her looking-glass adding the last touches to her evening toilet Her lover will soon be here! Her eyes are full of innocent lovelight! She looks eagerly at her reflection in the glass! How glad she is that she is pretty! She frowns a little at a crimp that will not stay just as it should. A ring comes at the door and she hastens away to meet her beloved.

A young wife sits anxiously watching for her husband. At each approaching footstep her heart beats rapturously, and then grows heavy with disappointment. She will not go indoors, it is so sweet out there! The creeping shadows cheer her trembling soul; so she waits and wishes, and the shadows lengthen into darkened night.

A mother is rocking her baby to sleep. He looks at her gravely while she moves to and fro, as if asking how the bright sunshine must leave and the ugly shadows hide her dear face from him. There is a wealth of wisdom in his great, sweet eyes. He holds tightly to her dress, as if to keep her near him. When at last his eyes are closed she disengages the loving hand, kisses him lightly—as he must not be awakened—and arises to put him into his crib. Then she sinks back into her chair and begins to rock again. It is so pleasnt to rest in the twilight, and he is so sweet to nurse!

A woman kneels by a fresh-made grave. The headboard stares coldly at her and seems to say over and over again the words inscribed upon it: "He was her only child and she was a widow. With tear-laden eyes she bends down lower and lower, till her lips rest upon the earth. She longs so to kiss the quiet form it is hiding from her! And the twillght seems to hurry past and lose itself in the darkness.

A careworn old woman sits watching the shadows come—they are friends to her—friends that she welcomes, for they always sing the same song to her, "One day nearer home." And she smiles on them her thanks. She, too, repeats "One day nearer home." And so life—woman's life—goes on in the twilight till rest comes to her weary body and joy to her aching heart—till her spirit reaches its home, where never a shadow can fall upon it.

A Woman's Wit.

Come, let us cast a vote and see,
Said I to Nell one day,
If we in wedlock's bonds shall be
Made one—what do you say?

The maiden answered, I agree
To your proposal so
We voted, I a "yes," and she,
To my dismay, a "no."

Our ballots steadily we cast
That day, but nothing gained,
For when an hour or so had passed
The vote unchanged remained.

As we prepared to vote again
And all my hopes had fled;
We'll try another vote and then
We'll give it up, I said.

Nell sweetly smiled and looked at me
As I sat frowning there.
Why need we vote at all, said she,
Why can't we simply pair?

—*New York Press.*

A female jewelry drummer is the latest novelty on the road in Maine. She is handsome, dresses stylishly, wears a man's soft felt hat, and hails from New York. She is away up on the art of traveling, cannot be imposed upon by hotel clerks, hackmen, or railroad men, and always sells as many goods as the smartest of her male companions.

How to Clean and Care For Silver.

One lady inquires about polishing silverware that has become much tarnished, and another writes that her napkin-rings of good silver turn black inside, and whiting will not remove the stain, says Maria Parloa in *The Ladies' Home Journal*. After reading these letters I looked at my own napkin-rings and found that one of them—ste ling silver—was rather black inside. I wet whiting with diluted ammonia water and rubbed for some time, but made little impression. Then I wet the whiting with undiluted ammonia water, and, after much rubbing, removed all the tarnish. It was evident that the inside of the ring had been neglected too long a time. Wetting the whiting in diluted household ammonia will usually cause all tarnish to disappear. I do not like to use it very strong on plated-ware. Coal gas and foul air tarnish silver. It is well to keep your ware in Canton-flannel, but do not put it in bags made of ordinary flannel, because the sulphur in that cloth quickly blackens the metal.

Heroism of Female Convicts.

Women, and women convicts at that, were the heroines of the wreck of the Enterprise, on the Andaman Islands during the recent cyclone, says the *Chicago Tribune*. The ship was cast upon the Island used as a penal colony and stranded in front of the building that sheltered the female convicts. The women convicts went to the rescue. It was a struggle to live, even on land, exposed to such a storm, but the stout-hearted women literally fought their way to the beach. There, in the face of the thundering in-rush of the waters, which at times swept high above their heads, they formed a human life line, each woman grasping the others' hand. Then the head of the line rushed into the sea and grasped a struggling form seen twirling and twisting in the water, and, aided by their companions, dragged ashore one of the men who had been swept from the wreck of the ship. Again and again the women entered the water and each time they returned with a man who, had it not been for their aid, would have been drowned. Of the eighty-three men comprising the officers and crew of the Enterprise only six were saved, and every one of these six were dragged from the water by the women—women who have been branded as criminals. Every English officer and every English member of the crew of the Enterprise were lost.

THE END OF FALL.

An antiquated katydid
Whose wings aro growing hoarse,
Sits on a tree at noonday,
Quite filled with grim remorse.
His pale-green friends have left him;
He's stiff; he scarce can crawl;
For hi—ho—Jemimy! 'tis the tail end of fall.

Heaps of yellow pumpkins
Are lying 'gainst the fence
And leaves are thick on everything—
To sweep them isn't sense.
A blue-bird's in the neighborhood,
I hear his autumn call;
For hi—ho—Jemimy! 'tis the tail end of fall.

I meant to ask Philona
To marry me in June;
I really thought I'd whoop it up
Enduring the August moon.
If I don't cut and ask her
She won't marry me at all;
For hi—ho—Jemimy! 'tis the tail end of fall.

—Ione L. Jones.

Can a Woman Drive a Nail?

When Mrs. Palmer drives tho last nail in the Women's Building of the World's Fair all the world will stand and listen.—*Chicago Paper.*

Now what is offered on the speed with which Mrs. Palmer drives the nail? Two to one on the nail. Ten to two that Mrs. Palmer hits the building five times for once she hits the nail. One hundred to twenty-five that she hits her fingers if the nail isn't started for her. Even money that she gets the hammer tangled in the ribbons of her bonnet. Eight to ten that she shuts her eyes for the first blow. Five to four that she wrinkles her nose after the first twenty-five blows with the hammer. Even money that the world will have to take a recess for lunch before the nail is driven, providing that Mrs. Palmer doesn't begin to hammer at it before 10 o'clock. Even money that after Mrs. Palmer works eight hours the nail will have to be turned over to a carpenter. Ten to one that the nail is leaning to the south-west when Mrs. Palmer quits.—*Detroit News.*

Never Mention Names.

Leaves her breakfast dishes standin' in the middle of the floor,
Hurries off to do an errand at the little country store,
Makes about a dozen calls on as many patient dames,
Lets a flood of gossip loose, but never mentions names.

Knows what couple's settin' up most every Sunday night—
House just across the way from her's and bleeged to see the light;
Tells where the dress is being made to honor Cupid's claims,
And when the weddin's coming off, but never mentions names.

Heard just now a certain daecon not a thousand miles away—
Right on hand to every service and the fust to speak and pray—
Recently was catched at sheatin' and at various other games;
For her part she doesn't wonder, but she never mentions names.

Been a most unwillin' witness to a dreadful family row—
Woman wouldn't give an inch, and husband wouldn't bow—
Peace and comfort all gone up in anger's risin' flames,
Lookin' for a separation, but she never mentions names.

Such a one is mean and stingy and another puts on style;
Half the folks are proud and haughty and the rest low-down and vile;
Nothin' in creation suits her, so she frets and scolds and blames,
Mighty sly and underhanded, for she never mentions names.

You and I have seen this person, and have listened to her tongue
Going like a barrel of water that is running at the bung;
And we know just where to place her, with her petty, groveling aims,
But we'll follow her example and refuse to mention names!

—Rochester *Democrat.*

Knowledgeous American Women.

Two people in a car the other night overheard the conversation of two people behind them. It was an amusing conversation, and it reported verbatim would be very interesting as showing the large range of ideas of American women. It embraced everything from Sir Edwin Arnold's last poem to Redfern's new forewoman; from the Princeton-Yale football game to the latest thing in cocktails. From the ingenuousness of the discussion the listeners imagined the woman to be a girl of, perhaps 18; she proved, however, to be a woman of 30 or more, which accounts, possibly, for that same ingenuousness. They finally fell to talking about champagne.

"I do so love champagne," she said. "The first taste is not quite all I expected, perhaps, but the second is an improvement and the third is delightful. I begin to feel a dolicious glow on my forehead, as if somebody with warm hands were holding my face; I have a little warm spot at the pit of my stomach and I feel enthusiastic over everything that is talked about. By the time I've had two glassos I don't want to go home; by the third I won't go home; and at the end of the fourth I don't go home—till I get good and ready,"—*New York Recorder.*

Young Women in The South.

The fact that so large a proportion of the young women now attending southern colleges are securing an education not for ornament but for use, not for social culture merely but in preparation for self-support, has had the very natural effect of making them more earnest and diligent in the prosecution of their studies. A much larger portion of college girls comes now from the middle and poorer classes than formerly. Many of the poor girls of the south to-day are the daughters of educated parents whose property was swept away during the war, their culture surviving the loss of home and property. And what will an educated and refined mother not do, what sacrifices will she not make, in order that her daughter may have the benefits of an education? If poor she will practice the most rigid economy and submit to the severest personal self-denial if thereby her daughter is enabled to enjoy the advantages of an education; and many are the southern mothers who since the war have done this, and more, to give their children an education. And there are many noble instances in which an elder daughter, having been thus educated through the labor and economy of her parents, has generously requited their loving self-denial in her behalf by going to work herself and helping each of her younger sisters to obtain the education which their parents were anxious but unable to give them. It is Victor Hugo who has called this "the century of woman." It is certainly an age that has witnessed great changes in the life, education and labor of women everywhere; and these changes have all been in the direction of enlarging the sphere of woman's activities, increasing her liberties and opening up possibilities to her life hitherto restricted to man. It is a movement limited to no land and to no race. So far as this movement may have any tendency to take woman out of her true place in the home, to give her man's work to do and to develop masculine qualities in her, it finds no symyathy in the south. The southern woman loves the retirement of home, and shrinks from everything that would tend to bring her into the public gaze. The higher education of woman, which has been so widely discussed of late years, and to encourage and promote which such noble schools for women as Wellesley, Vassar, Smith and Bryn Mawr have been founded, and so many great male universities in the north and in England thrown open to them, is duly recognized and felt among the young women of the south. This widespread aspiration of southern young women for broader culture finds expression in the eagerness with which they are seeking admission into the best of the higher institutions provided for males, and this not because co-education finds favor in the south—for it is, perhaps, less encouraged here than in any other part of the United States—but only because there is no higher institution of learning for women which provides for them the extensive facilities and broad culture furnished by at least a few institutions for young men. Many feel that the greatest educational needs of the south to-day is an institution that will provide for young women as thorough an education and as broad a culture as is provided for young men at the University of Virginia, the Vanderbilt, or Johns Hopkins—an institution that will not be in competition with any existing female college in the south, but will hold itself above them all by establishing and rigidly maintaining high condition of entrance as well as graduation, and whose pride will be the high quality of the work it does, not the number of pupils it enrolls, though numbers would also come in due course of time. The active, earnest, vigorous young womanhood of the south is demanding such an institution. Surely a demand so just and a need so widely and seriously felt can not go long unmet. Where is the philanthropist who will bless his own and succeeding generations, and make himself immortal in the good he will do, by giving the young women of the south a Smith college, or a Wellesley, or a Vassar. Is it possible that a million dollars could be spent in any way where it would accomplish more good than in the founding such an institution for the daughters of those noble women of whom we have written.—W. F. Fillet, in *The Century.*

Advice to Girls

Don't conclude that a man is a gentleman because he has the manners of one.

Don't think because a man is a graceful and interesting talker that he is every thing else.

Don't fail to take a man at his word when he says he is poor.

Don't be familiar with men, and don't permit familiarities from them.

Don't think because a man likes you that he wants to marry you.

Don't think that a man is not in love with you because he has not proposed to you.

Don't be silly about the men.

Don't be rude to a man in order to show your independence.

Don't let a man impose upon you simply because he is a man.

Don't believe everything a man tells you, either about himself or yourself.—*Detroit Free Press.*

Mrs. William H. Crane has been the treasurer of her husband's theatrical company since 1876. She collects, pays salaries, bills for printing and other expenses, attends personally to the banking, sending of money orders and all other business connected with her position, handling from forty to sixty thousand dollars per month during the season.—*Evening Lamp.*

A Woman Civil Servant.

Miss Cresswell the postmistress of Gibraltar, is an official who has a very important part to play in the regular business of the colony. She is the superintendent of the government telegraph office, and for the last five years has had sole control of the post office, with a large staff under her, and branches at Tangier, Magzagan and other towns of Morocco. Miss Creswell gets $2,800 a year and occupies the unique position of being a female civil servant.

LITERARY NOTES.

The New "El Dorado," Vol. 1, No 1, is the latest arrival in El Dorado Springs, Mo. It claims to be "a first-class journal, published for the people." And judging from its first edition, the people of that city will be proud of their weekly paper.

The O. H. Jewell Filter Co., of 73 W. Jackson street, Chicago, have issued their illustrated catalogue for 1892. Their pressure and gravity systems are fully described and illustated therein, giving dimensions, capacity, etc.

"Marvels of the New West" is really what it has been represented to be in the advertisements. It contains a large number of original engravings, and affords an intelligent insight into the wonders of the great New West. It is well printed, on first-rate paper, and is substantially bound in a very good cover. No library can be complete without this new book. It sells rapidly, we understand, and agents are making money with it. Further information may be obtained from the publishers. The Henry Bill Publishing Co., Norwich, Conn.

SCRIBNER'S MAGAZINE.

An Exceptional Year.—The year 1891 has been marked by a greater advance that any similiar period since the Magazine was established. Not only has the literary and artistic excellence been maintained and increased, but a corresponding gain has been made in the sale and influence of the Magazine. At the end of 1891 the circulation has risen to more than 140,000. It may justly be promised that the further improvements for the coming year will be proportionate to these largely increased opportunities.

For Next Year.—It is not possible to give, in a brief space, an account of all the features in preparation, but the material is deficient in neither importance nor range of subject. Among the subjects treated: *The Poor in the World's Great Cities.* It is proposed to publish a series of articles, upon a scale not before attempted, giving the results of special study and work among the poor of the great cities. The plan will include an account of the conditions of life in those cities (in many lands) where the results of research will be helpful for purposes of comparison as well as for their own intrinsic interest. While, from a scientific point of view, the articles will be a contribution of great importance, the treatment will be thoroughly popular, and the elaboaate illustrations will serve to make the presentation of the subject vivid as well as p'cturesque.

Washington Allston.—Unpublished reminiscences and letters of this foremost among early American painters. A number of illustations will lend additional interest to the articles.

Important Moments.—The aim of this series of very short articles is to describe the signal occasions when some decisive event took place, or when some great experiment was first shown to be successful—such moments as that of the first use of the Atlantic cable, the first use of the telegraph and telephone, the first successful experiment with either, the night of the Chicago fire, the scene at the moment of the vote on the impeachment of Andrew Jackson, etc., etc.

Out of Door Papers.—In the early spring will be begun a number of seasonable articles, among them being:

"Small country places," how to lay out and beautify them, by Samuel Parsons, Jr.

"Fishing lore from an angler's note-book," by Dr. Leroy M. Yale.

"Mountain station life in New Zeland," by Sidney Dickinson.

"Racing in Australia," by Sidney Dickinson, with illustrations by Birge Harrison.

The illustrations are made from original material. A full prospectus appears in the Holiday Number, now ready. Price 25 cents. $3.00 a year.

Charles Scribner & Sons, Publishers,
743 and 745 Broadway, New York.

BUSINESS NEWS.

Lawyers (like those of other professions) are good, indifferent, etc. We have much pleasure in introducing to those of our readers who may be in need of legal services a firm of lawyers who stand on top on the list of good ones, namely Dahms & Langworthy, of 115 Dearborn St., Chicago.

The Van Auken Steam Specialty Co., have a notice on page VIII in this issue, in their advertising space, which is important, and should be read by all engineers. Look for the cut and read the article.

The Hartford Engine and Machine Works, which since being burned out have been temporaly located at No. 83 Commerce street, have removed to their old location No. 223 State street. Hartford, Conn., where a large three story building has been erected and with plenty of room and increased facilities they will be better prepared than ever for making their engines of which they now build both horizontal and vertical, plain and automatic, from two horse power upward.

Commissioners Groner and Lindsay and Directors Lawrence and Peck have been appointed a committee to call on President Harrison and the Secretary of the Navy to ascertain what, if any, expense of the naval rendezvous at Hampton Roads and review in New York harbor in April, 1893, should be borne by the Exposition management. Many are of the opinion that the government ought to foot the bill.

CONTRACTS OPEN.

Comptroller's Office,
City of New Orleans,
New Orleans, Nov. 20, 1891.

Sealed Proposals will be received at this office until the hour of 12 m., Thursday, February 18, 1892, for the construction of a new drainage pump, in accordance with plans and specifiations on file in the office of the City Engineer. Copies of plans and specifications will be forwarded by mail on request.

A deposit of $200 will be required to accompany each bid.

The city reserves the right to reject any and all bids.

All in conformity with Ordinance No. 5753, C. S., adopted Nov. 10, 1891.

F21 Otto Thoman, Comptroller.

Drawbridge.— Competitive plans for a drawbridge across the Duluth ship canal will be received by the board of public works in and for the corporation of the city of Duluth, Minn., until 2 p. m. on the 28th day of Debember, 1891, said plans to be drawn according to notes and specifications for the size and strength now on file in the office of said board, which will be furnished upon application. A cash prize of one thousand (1,000) dollars will be paid for the best plans furnished. Said plans must be accompanied with detail specifications and approximate cost of said bridge. The successful bidder in all probability will, if so desired, be engaged by the city of Duluth when the bridge is built to superintend the building of the same.

Official Seal. Henry Truelsen, President. T. W. Abell, Clerk, Board of Public Works.

Water-Works Franchise.—The city of Cape Girardeau, Mo., desires to let a franchise to a private company to build and operate Water-Works. Plans and specifications are now on file with the undersigned, and with Johnson & Flad. Consulting Engineers, Laclede Building, St. Louis.

Sealed proposals will be received up to 6 o'clock p. m. Monday, the 7th day of December, 1891.

Other systems will be investigated if submitted.

The Mayor and Council reserve the right to reject any or all bids. H. P. Pieronnot, Mayor. Attest, Geo. E. Chappell. City Register.

Steam Heating.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until the 11th day of December, 1891, for all the labor and materials required to fix in place complete the low pressure, return circulation steam heating and ventilating apparatus for the United States Post Office, etc., building at Jackson, Mich., in accordance with the drawings and specification, copies of which may be had at this office, or the office of the superintendent at Jackson, Mich. Bids will be considered for any other system of heating and ventilating, in lieu of the above' and parties proposing to supply such must submit, with their proposal, plans and full specification for same. Each bid must be accompanied by a certified check for a sum not less than 2% of the amount of the proposal. Proposals must be sealed and marked "Proposals for the low Pressure, Return Circulation, Steam Heating and Ventilating Apparatuus (or otherwise, as the case may be) for the United States Post Office Building at Jackson, Mich.," and addressed to W. J. Edbrooke, Supervising Architect.

THE RAU PERFECTION OILERS AND BENZINE CANS.

Oil is an important factor in the engine room—more important than is often considered. It is necessary to oil enough, and yet most desirable not to oil too much or let the oil run to waste.

We have much pleasure in illustrating herewith the "perfection" cans manufactured by the Rau Manufacturing Co., whose head offices are at 64 and 66 West Monroe streets, Chicago.

With the "perfection" can the flow of oil is instantly controlled by an air-tight cut-off at the inner opening of the spout, and is operated at will by pressing connecting push-stem just in front of can handle as shown in the cut.

In use, the spout remains full of oil. The flow starts by the pressure of oil and air the instant the valve is raised from its seat inside the can. The flow is stopped as instantly by the valve returning to its place. The air pressnre at the end of the spout prevents one drop from escaping, it is claimed.

Having the oil under perfect control is a great aid in keeping machinery clean, and it prevents the waste of oil, as is the case with many of the common cans.

In oiling many kinds of machinery the spout of the oil can is necessarily pointed downward, and as much oil runs out on the ground or floor as is used for the machine. The "perfection can" saves all this loss and annoyance, for no oil escapes from it until the push-stem is pressed, no matter what the position of the can may be.

According to a report of tests made, to prove the actual saving of time and oil, it was found that the Rau perfection oil can saved fifty per cent. both of oil and time, the different cans being used by the same man. In other words, a man with the perfection can oiled a machine in exactly one half the time that it took him to do the same work with an ordinary can; and, more than that, only about one-half the qnantity of oil was used with the can shown herewith.

The manufacturers state the amount of oil actually saved by nsers of large machinery, in four weeks time, by using the "perfection oiler," exceeded more than the price of the can.

The "perfection upright oiler," as shown in the cut, is made with a double spout. This is the case with all that are 16 inches or over in length. This is nneqnalled it seems, for oiling locomotives and high machines. The object of the double spout is to secure extra strength. And where the cans are used in a freezing atmosphere, the double spout prevents the rapid chilling of the oil.

As a benzine can, the construction prevents evaporation. It also keeps the oil safe from ignition, even though a blaze reaches the openings. They are made in both brass and tin, and of the best quality.

Not only do they save time and oil, and ensnre cleanliness, but actually reduce the rate of insurance, as shown by the following letter:—

Office of the Chicago Fire Underwriters' Association.
CHICAGO, ILL., Feb. 20, 1890.

RAU MANUFACTURING CO.

Gentlemen—A long-felt want is unquestionably supplied by your Perfection Oil and Benzine Cans. They are not only the best I have ever seen, but I regard them as practically the only oilers, from my point of view as an underwriter.

They undoubtedly save the oil and labor as you claim, but, better than that, they virtually do away with the dripping of oil and benzine and the consequent accumulation of inflammable rags and waste now used to wipe up machinery, and they also do not allow the vapor from benzine to escape.

I shall require printers, and others using benzine, to use your can, as it greatly lessons the hazard and reduces the rate in connection with their insurance, and will cordially recommend the oil can to all owners or users of machinery, for the same reasons. Yours very truly,

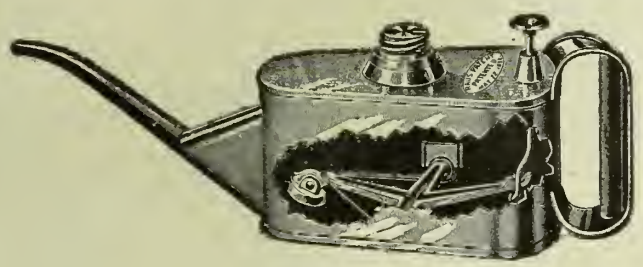
(Signed) T. A. BOWEN, Sup't of Surveys.

In the illustrated prospectus of the Rau Manufacturing Company there are numerous testimonials all showing that their perfection oil cans give excellent satisfaction and "fill a long-felt want." They are giving great satisfaction to the engineers of several railroads, and stationary engineers. It seems that they only want to be tried in order to be appreciated. "They are durable and economical" say Rand, McNally & Co., of Chicago. The following is a good specimen of the testimonials:—

LODGE, DAVIS & COMPANY.
CINCINNATI, OHIO, August 9, 1889.

RAU MANUFACTURING CO., CHICAGO.

Gentlemen—We have had your oil can in use for some time and consider it one of the best cans for use around a large planer, and to oil places where



PERFECTION OILER.

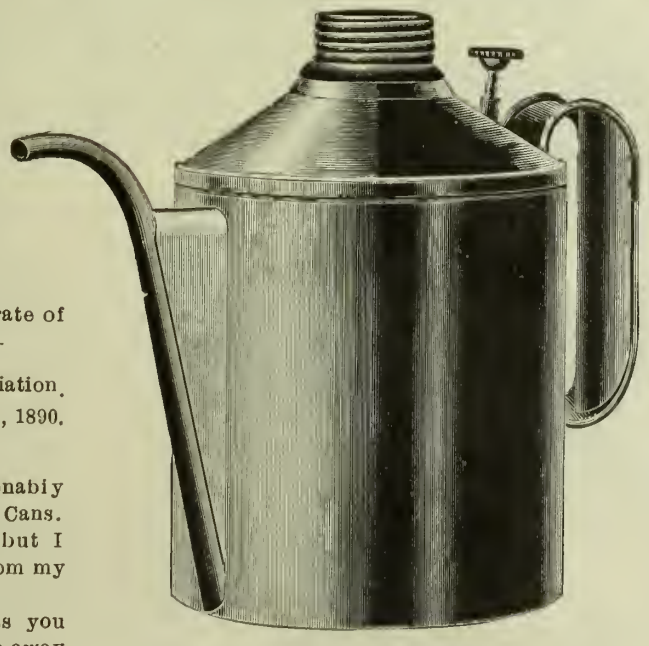
the oil-holes are hard to get at, that we have come across. The tendency of the regular can to waste oil while the can is in the downward position every one knows, and the saving effected by your can on this item alone is something wonderful; this, with its other qualities, and the fact that it is so strongly made, has decided us to substitute this for all the other oil cans we use. We enclose you an order that will do your heart good. Wishing you the greatest success, and giving your oil can our heartiest indorsement, we are, Yours truly,

LODGE, DAVIS & COMPANY.

A TRANS-ATLANTIC BOILER EXPLOSION.

An investigation of unusual interesting, and occupying three days has been held at Falmouth, England, concerning the explosion of a boiler on board the wrecked Bay of Panama, in Falmouth Bay, August 5th last.

Before describing the boiler says *Engineering* (from which this report is taken), it may be well to state that during the blizzard which occurred on the south-west coast in March last a sailing vessel called the Bay of Panama was driven ashore off

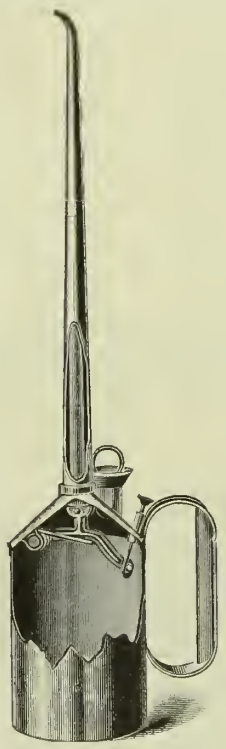


PERFECTION FILLER OR BENZINE CAN.

Falmouth and wrecked, the captain and several of the crew being drowned. Messrs. Anderson and Baker, of Falmouth, enterd into a contract with the underwriters to saive the cargo, which consisted of jute, and with this view hired from Captain Pearce, stevedore, Liverpool, at a cost of 12s. per day, a steam winch, together with the boiler, engine, and tank. Messrs. Anderson and Baker were to return the boiler and winch in good order or pay 200*l*. The winch arrived at Falmouth in April and was placed on board the wreck, where it was employed in raising the cargo. At about half-past three o'clock on the morning of Wednesday, August 5, the boiler exploded, and it was this explosion which formed the subject of the present investigation.

The boiler was of the vertical cylindrical internally fired type, and made in 1883 by Mr. William Bruce, of Liverpool. The shell was 6 ft. 6 in. in height, by 3 ft. 6 in. in diameter, made of iron plates $\frac{3}{8}$ inches in thickness. The transverse seams were single-riveted and the longitudinal seams double-riveted. The internal firebox, which contained two cross water pipes, was 4 ft. 2¼ in. in height by 2 ft. 11¾ in. in diameter, the plates being of iron, $\frac{3}{8}$ in. in thickness. Among other fittings with which the boiler was equipped when worked by Captain Pearce on the dock quays at Liverpool, were two safety valves, each 2 in. in diameter, one being of the open lever construction, and loaded with Salter's spring balance ferruled so that the safe working pressure of 70 lb. could not be exceeded, and the other a lock-up valve. The boiler was worked at a pressure of 65 lb on the square inch.

On the occurrence of the explosion the boiler was, doubtless, shot upwards like a rocket, but, as it was dark at the time, the persons engaged on board do not appear to have seen which way it flew. The entire boiler, however, with the exception of some portions of the firebox which remained on deck, was blown into the water, which, near the vessel, was 30 ft. or 40 ft. deep, so that all trace of it was lost. On the occurrence of the explosion steam and water rushed out at the firedoor side of the boiler towards the bow of the vessel. Several men were standing at the back of the winch, but were not injured. A man named Byford, however, who looked after another boiler which drove the ship's winch, was so seriously scalded that he died shortly afterwards, while another man named Rusden, who had only within the previous few days taken the post of fireman to the exploded boiler, was also severely scalded, but not fatally.



PERFECTION UPRIGHT OILER.

An examination of the fragments left on deck led to the conclusion that the internal firebox had collapsed. The cause of the explosion, as will be seen by a perusal of the evidence given before the Commissioners, was excessive pressure, the lock-up safety valve having been removed while the boiler was at Falmouth, and the spring balance of the open lever valve having been tampered with so that the safe working pressure of the boiler was very much exceeded.

Captain Pearce, a stevedore in Liverpool, purchased the boiler in 1884 to be used in connection with his business on the docks of the Mersey Board. According to the Dock Board regulations it was necessary that the boilers on that estate should be annually examined and certified by the Manchester Steam Users' Association. The boiler was duly examined from time to time by the inspectors of that Association, and was guaranteed in the first instance to a pressure of 80 lb. on the square inch, though this was subsequently reduced to 70 lb. The plates were slightly corroded, but at the last "entire" examination in November, 1890, the deterioration was so slight that it did not affect the bursting pressure, which was calculated at 275 lb., and the boiler was guaranteed to December 31, 1891, on the strength of that examination. Mr. Anderson hired the boiler in March last on the understanding that it should be returned in the same condition as when received, and no authority was given by Captain Pearce to Mr. Anderson to remove

Continued on page 240.

NEW FULL AUTOMATIC GEAR CUTTER.

(Patented December 1, 1891.)

The accompanying illustration represents a compact heavy tool, designed for the rapid cutting of spur gears, with range of work up to 36 inches diameter.

The capacity of this machine for turning out work is not equalled by machines of 50 or 60 inch range, it is claimed. The mechanism of feed and return of carriage is so simple of construction that it cannot fail to operate, and cannot get out of order; and it will readily carry a 2 inch pitch cutter to its limit.

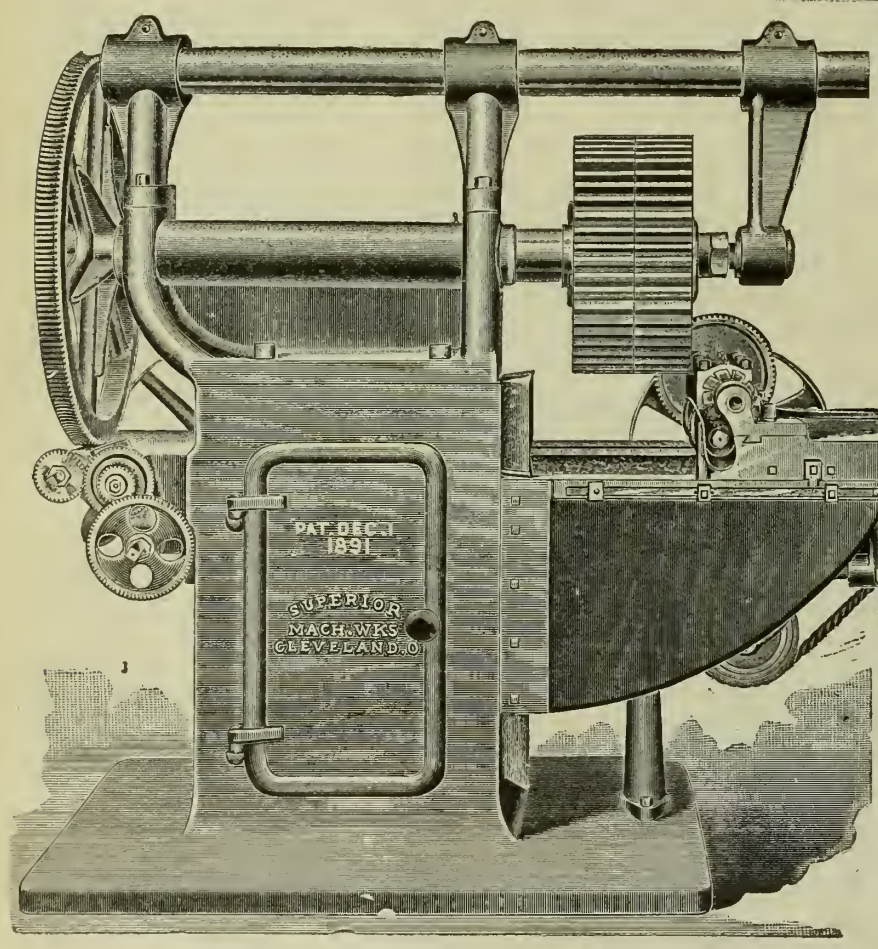
The mechanism for indexing also, which can be readily understood from the cut, consists of a locking dog which engages with notch in disc, and a latch which is hinged to lever engaging with the locking dog. Before the carriage reaches out end of stroke, the chain, by pulling on lever, releases locking dog from the disc, the lever being pulled back far enough to release locking dog by the projection in latch striking pin in front of it—the locking dog is again ready to engage with notch in disc. The head stock being 25 inches long affords a substantial support for the main spindle, which projects over slide, and is supported at outer end also on this portion which is two in. diameter the work is held. The cutter spindle is 1¾ in. diameter and has a bearing 10½ in. long—an indicator on front of bearing locates cutter. The knee on which the central carriage slides is a heavy casting, weighing 400 lbs., and is rigidly gibed to column and supported by vertical screw, which serves to raise and lower the same. The machine is driven by a four-inch belt, the tighten or take-up for belt being on countershaft overhead is a feature that users of gear cutters can fully appreciate. The table of change gears, as shown herewith in the preceding column is in keeping with the rest of the machine.

Cut.	Worm Gear.	Stud.	Disc.	Cut.	Worm Gear.	Stud.	Disc.
12	24	108/30	120	37	37	72/36	108
13	26	"	"	38	38	"	"
14	28	"	"	39	39	"	"
15	30	"	"	40	40	"	"
16	32	"	"	41	41	"	"
17	34	"	"	42	42	"	"
18	36	"	"	43	43	"	"
19	38	"	"	44	44	"	"
20	40	"	"	45	45	"	"
21	42	"	"	46	46	"	"
22	44	"	"	47	47	"	"
23	46	"	"	48	48	"	"
24	24	72/36	108	49	49	"	"
25	25	"	"	50	50	"	"
26	26	"	"	51	51	"	"
27	27	"	"	52	52	"	"
28	28	"	"	53	53	"	"
29	29	"	"	54	54	"	"
30	30	"	"	55	55	"	"
31	31	"	"	56	56	"	"
32	32	"	"	57	57	"	"
33	33	"	"	58	58	"	"
34	34	"	"	59	59	"	"
35	35	"	"	60	60	"	"
36	36	"	"	61	61	"	"

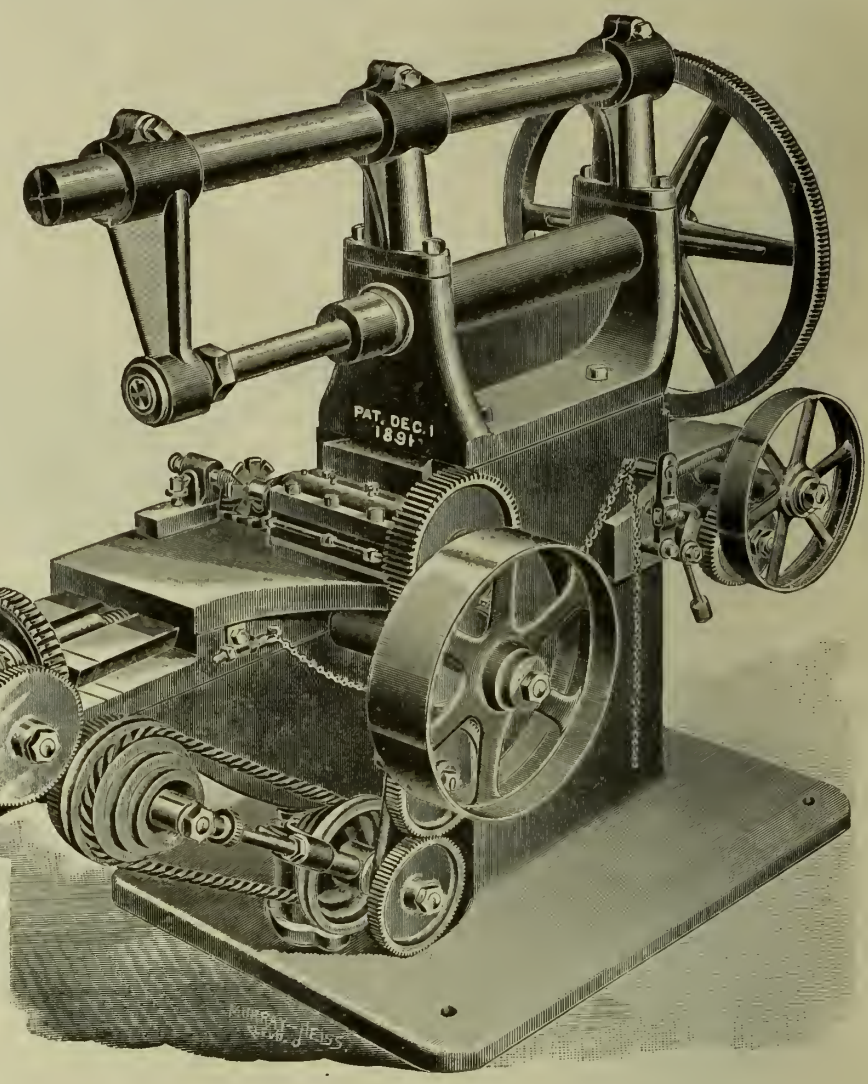
Pinions of 12 to 23 teeth are cut with a change gear having twice the number of teeth required to be cut. Gears of 24 to 61 teeth are cut with a change gear having exact number of teeth required to be cut. Above 61, the change gear is one-half, or one-third, of the gear required to be cut—a system that will save many costly errors.

Weight of machine 4,000. Speed of counter 130.

Manufactured by the Superior Machine Works, 106 Canal St., Cleveland, O.



New Full Automatic Gear Cutting Machine.



New Full Automatic Gear Cutting Machine.

ECONOMY OF ENGINES AND BOILERS.

The practice of expressing the economy of a steam engine in so many pounds of coal per horse-power per hour has been almost universal in the the past, and although some few engine builders are using a different standard the former may still be considered the prevailing method. Certainly nothing could be more fallacious than to speak of the consumption of fuel by the engine, which consumes steam only, or should if proper conditions exist.

An improved automatic cut-off engine is sold under guarantee of a fuel consumption of, say, 3 pounds of coal per horse-power per hour. How does the maker arrive at this figure, not knowing the economy of the steam generator? With an average boiler performance the quantity of steam supplied to the engine on the above rating will be that due to the evaporation of about 7 pounds of water evaporated per pound, or 21 pounds of water per 3 pounds, from and at 212 deg. F. Therefore the economy of the engine should be rated at 21 pounds of water per horse-power per hour, instead of 3 pounds of coal. This is definite and rational, as it eliminates all unknown qualities and rates the engine on a basis which has to do only with the functions performed by and chargeable to it.

No engine builder would care to have his work undervalued by charging against it the efficiency of the boiler. If he knows the boiler from which it is proposed to run his engine to be exceptionally economical he will certainly show a great want of business judgment if he does not reduce his coal rating; for instance, if the boiler gives 10 pounds evaporation and the engine can run on 21 pounds of steam he will hardly care to have it rated at 30 pounds, neither would it be a fact.

Again, if the boiler is extravagant and gives but 5 pounds evaporation, it would be an absurdity to say that the engine was running on 15 pounds of steam (or water), as that would indicate just the reverse of existing conditions, and extravagance would be expressed as economy.

Every builder of high class engines knows from the indicator cards just how many pounds of steam at normal saturation will be consumed per hour for each horse-power developed by his engine, and on this rating he can give an economy guarantee which is free from all complications, and means neither more nor less than is intended. Why not all builders follow the example of the advanced few?

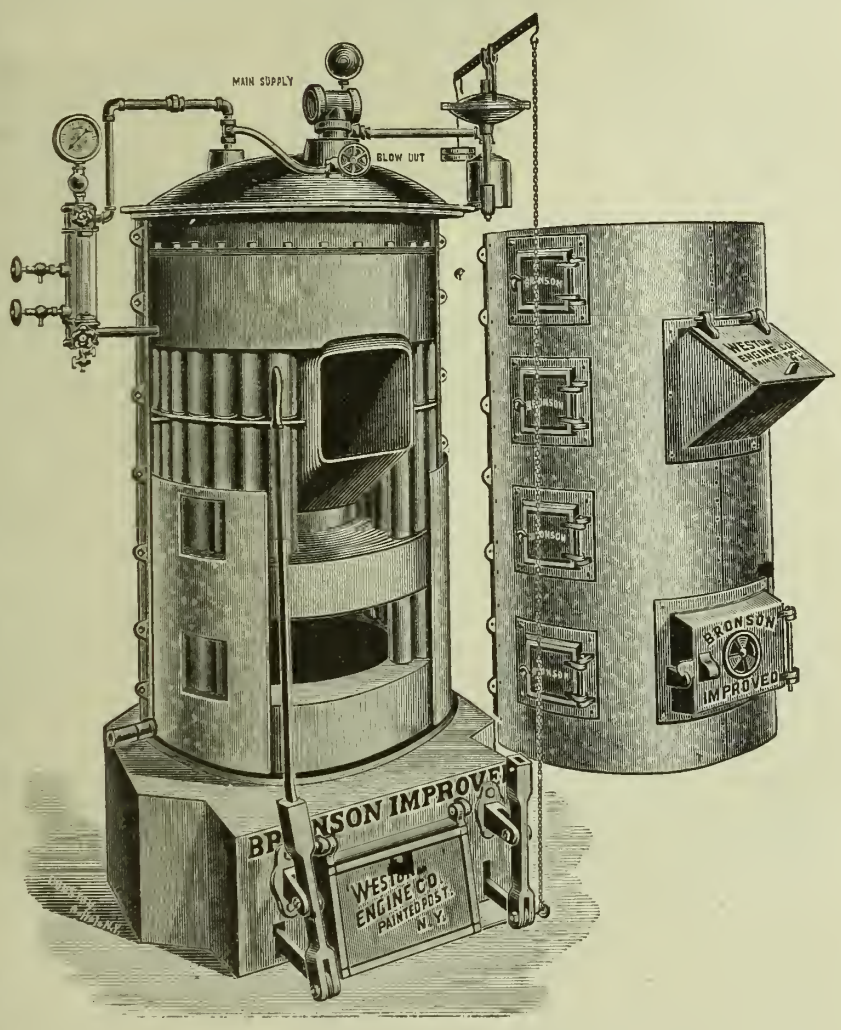
As to the horse-power rating of boilers, as it now stands, it is purely nominal and misleading, for the reason that it does not express facts according to improved practice. If a standard weight of evaporation be adopted, and a standard water consumption by the engine, it then becomes merely a matter of substituting a more perfect for a misleading standard. As 24 pounds of water would be a fair average performance, the boiler power could be expressed in horse-power by dividing its evaporation per hour by this constant, and its economy by dividing the evaporation by the fuel consumed as usual.—*Iron Age.*

THE BRONSON WATER-TUBE BOILER.

The Weston Engine Co., of Painted Post, N. Y., seem to be thoroughly imbued with the principle that whatever is worth doing at all is worth doing well. We had the pleasure of giving a fully illustrated description of the Weston engine recently. Now we show and explain the principles of their Bronson water-tube boiler. And it may not be amiss if we extract trite statements from their circular of "some red letter facts."

Science long ago demonstrated the greater efficiency, as heating surface, of the outside of a tube as compared with the inside of the same; and, it may be stated as a fact, other things being equal, a convex surface is far more valuable as heating surface than a flat or concave surface.

This principle is often disregarded in high-pressure boilers upon other considerations than economy in fuel, but these boilers work with an enormously higher furnace temperature than a low-pressure heating boiler, and the absorption of all the available heat of the gases of combustion, while of vital importance in the low-pressure boiler, is of less consequence in the high-pressure. A little study will show that the two boilers work under radically different conditions, and that a design suitable for one may be totally inapplicable to the other.



The Bronson steam heater is an improved form of water tube boiler, every part of which is fire surface of the highest efficiency. It is made principally of the best steel tubing, manufactured expressly for the purpose. Referring to the cuts it will be noticed that these tubes are connected with each other by three sections—the bottom or fire-potring—the middle ring, the central aperture of which forms the lower end of the coal magazine, and the upper section or steam dome. These are all connected together with steel tubes, the joints being of a peculiar nature, precluding the possibility of leakage, and binding all parts of the boiler into practically one piece of metal, this solidity, does not, however, incur the risk of unequal expansion, as this is thoroughly provided for and can never occur to an injurious extent, it is claimed. The boiler is filled with water to at least four inches above the top of the tubes, thereby giving assurance of their durability. In the front of the boiler is the inlet of the magazine for holding a supply of hard coal sufficient for twelve hours, thus insuring fire day and night. The design and proportion of this boiler were determined by most careful experiments extending over a period of five years. There is a much larger proportion of heating surface to the grate surface than any other, in itself a long step toward economy.

In the Bronson boiler, it is maintained, all the heating surface is of the highest efficiency, is vertical, and readily accessible, thus providing for keeping a clean boiler with the least possible trouble. The hot gases of combustion leaving the fire, pass outwardly between a double row of tubes, then, passing upward, are deflected to the center of the boiler, crossing all of the tubes, again deflected to the outside, then across the tubes the third time, and finally pass around and over the steam dome before finding their way out. This peculiar arrangement of vertical water tubes and horizontal deflections, provides at once for the most perfect circulation possible, and for the absorption of the heat in the gases, a point seldom before realized, but which must be obtained before a steam heating boiler can make the slightest pretense toward economy, as the manufacturers maintain.

Farther information, and illustrated catalogue, may be obtained from the Weston Engine Co.

THE BEVINGTON WELDING PROCESS.

The sub-committee of the Committee on Science and the Arts, constituted by the Franklin Institute of Pennsylvania, to whom was referred for examination James H. Bevington's improved mode of welding metals and shaping tubes, reported that in its opinion the invention deserved recognition by the award of the Elliott Cresson medal. The bestowing of this medal is looked upon as a high tribute. The original fund was $2,000, but it has grown to $50,000, because the committee has been particular in making the award.

The Bevington process is owned and operated by the New Process Welding and Spinning company of Chicago. It consists in forcing strips, rods, or tubes of ductile metal into converging revolving dies of harder metal, in which they become heated and compacted and acquire the shape of the interior of the die.

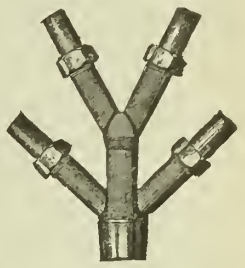
The invention already has been applied commercially with satisfactory results to cartridge cans for dynamite projectiles, and is said to develop fully the best strength of the material. The device appears entirely novel, is simple, easily managed, economical, and does not require a costly plant.

A successful method of preventing coal-dust explosions has been adopted in various German mines. The usual method of sprinkling water in dusty parts of the mine has only a limited value, as much of the dust generated in the mining of coal is thereby unaffected. Water is now forced under a pressure into the coal to be mined, thus not only settling the dust in advance but facilitating the removal of the coal. Holes one meter deep are drilled at a distance of about three meters. Here wooden plugs are inserted and through them are run iron pipes from ¾ to 1 meter long, with openings between 2½ and 3 millimeters large and connected with rubber hose. Important factors in the successful application of this method are the water pressure obtainable, the quantity of water injected and the firmness of the seam, the last item depending to some extent on the size of the coal pillars in the workings

BRASS WATER CONNECTIONS.

The cut on the upper part of this column represents the No. 6 system of water connections manufactured by the H. Mueller Manufacturing Co., Decatur, Ill.

In view of the fact that in a great many cities where high pressure systems are used they will not allow a larger tap than one inch in the mains (as it is claimed that the pipes are weakened too much), and as, from time to time, this company has been called upon to furnish connections for supplies larger than one inch, they have gone to the expense of making a special line of patterns, and they are now prepared to meet the wants of their customers by supplying water connections for 1¼ inch, 1½ inch and 2 inch supply pipes.



No. 6.

Cut No. 6, shown herewith, represents connections with soldering unions on branches, and for lead on outlet. But they will furnish connections of any particular kind to suit special requirements.

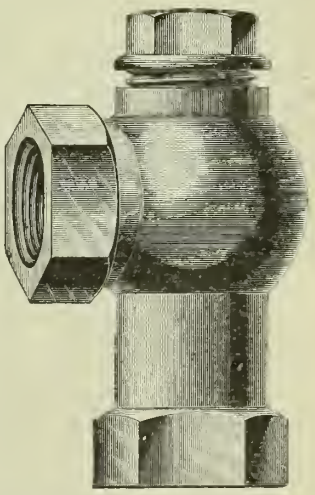
All of the Mueller connections, however, are so constructed that the flow of water through the different branches does not obstruct each other.

HAYTHORN'S AUTOMATIC RETURN VALVE.

The illustration below shows Haythorn's automatic return valve for radiators, box coils and circulations.

This valve needs no packing, nor any attention, it is said. "The object of it is to do away with the packing of valve stems, and to prevent the freezing and bursting of the pipes. It requires no attention from either the engineer or the janitor," says the manufacturers, Wm. Levy Haythorn & Co., 94 Franklin St., Chicago.

When the supply valve is opened on the radiator, the ball drops down into the disc and discharges the water into the return pipe; and through the day, when the supply valve is shut, the back pressure from the return pipe causes the ball to rise, thus keeping the water out of the radiator. At night, when the engineer closes his valve on the boiler, the ball then drops, and all the water drains out of the radiator, thus preventing the pipes from freezing.



Should it become necessary at any time to examine the valve, all that is required is to unscrew the cap and seat, lift the rubber ball out, which can be done without removing valve from radiator.

Haythorn's patent strainer for steam traps is another useful device, made by the same company.

The object of this patent strainer is to prevent the steam trap from choking up with dirt, red lead, and sediment that collects in the pipes.

Mr. Haythorn informs us that the company's business promises a very marked increase in volume as the season advances. They have a number o excellent contracts in process of negotiation, and have recently shipped, through a New York house, a large number of their valves to London, England.

William Ordway Patridge, the great sculptor, has asked for space in the Art Palace for his statue o Shakespeare, which he is now making for Lincoln Park. His statue of Alexander Hamilton, which he is making for the city of Boston, will also be shown. Mr. Patridge is vice-president of the American Artists' Association in Paris. He gives assurances tha the association is heartily interested in the Exposition.

The American Engineer.

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CONTENTS OF THIS NUMBER.

MATRIMONIAL bonds are pleasant, when the husband and wife are properly mated. Mrs. Peerman's letter in our Women's Department this week, shows that she believes that wives should truly "love, honor, and obey" their lords and masters. She takes no stock at all in Col. Bob Ingersoll's sexual flattery, it seems. Robert does not seem to have any idea that the bonds of matrimonial love are really pleasant and greatly desired.

BEET sugar is one of the youngest of American industries. A letter from Bro. M. W. Ingalls in this issue, gives an "insight" into the first American beet sugar manufactory, which is located at Lehi, Utah. The A. O. of S. E. is to be congratulated on having one of its members filling the position of chief engineer of this great manufactory; and Multnomah Council, in particular, cannot fail to be delighted to hear from their old comrade, and read his letter concerning the first American manufactory where beet sugar is made.

ARRESTED for larceny, and held to the grand jury, is the last stage (so far) reached in the career of Mr. Jefferson Young, Jr., as appears from the Syracuse, (N. Y.) *Times*, whose report of the case is given in another column. He is accused of misappropriating (for his own use) a sum of money ($132) which he collected from Joseph Wallier, of Syracuse instead of sending it to the firm for whom he was acting as agent. From a telegram which was published in the Chicago *Tribune* it appears that the accused claims he had a right to keep the money. His whilom employers evidently think otherwise. And further developments may show who is right. At all events the dispute is a serious one. And if it turns out that Mr. Young does not know where to draw the line between what belongs to other people and his own, his moral sense must be quite defective. Although we have been aware that he "does some queer things sometimes," as quoted in a recent issue (from a letter written by one of his best friends), to find that he is accused of grand larceny staggers us, and we are truly sorry that a former acquaintance has become subject to such a charge. He obtained the $132 on Aug. 22 last. He is urther charged with keeping the sum of $465 since July 27, 1891.

OLD NEWS AS NEW.

The AMERICAN ENGINEER, April 25, 1891:—

The Moline Plow Company, of Moline, Ill., obtained $25,000 from an English syndicate recently. Perceiving that the plow works was a good property to possess, they secured the option thereon, by paying down the sum mentioned—twenty-five thousand dollars—which right of option expired March 1st last. The disturbance in the money market upset the calculations of the English syndicate, and they were unable to buy the Moline Plow Works, so the option money was forfeited. The Moline Plow Co. have decided to use some of this English money to buy new machinery.

The *Chicago Tribune*, Dec. 4, 1891:—

MOLINE, Ill., Dec. 3.—[Special.]—Last summer a syndicate of English capitalists secured an option on the purchase of the Moline Plow company, the terms of sale, $800,000, to be paid Oct. 1, to which time an option of $25,000 was paid. When Oct. 1 came the syndicate failed to produce the amount stipulated, the representatives claiming that stockholders in the plow company had written to the London capitalists repudiating the contract. For several days H. C. Parker of London and G. G. Willard of Chicago have been in the city attempting to recover the option money but failed, and there is promise of litigation.

LARGE ELECTRIC CENTRAL STATIONS.

There are many advantages in having large electric central stations. They can be operatad more economically than small ones. This fact has been dilated upon, by many speakers and writers for the past two years or more. There is another side to the question, which has been somewhat overlooked, perhaps, namely, the risk of a severe loss by fire, such as that reported in our last issue, and great inconvenience arising therefrom to the public. This other side is shown forth by "The Doctor" in our Correspondence department.

The proper way to determine a question of this kind is to place the advantages against the disadvantages, and let the greatest decide the matter The balance, we believe, will be found greatly in favor of large central stations. It is true that the damages and inconvenience from the burning of a small central station would be much less than when a large station is burned; but it is equally true that the advantages derived from a small station are inferior to those of a large one.

Then, again, conflagrations from electric wires are of very rare occurrence. And the advantages from large electric central stations generally far outweigh the losses and inconvenience from the electric conflagrations which occur rarely from the short circuiting of the electric current.

To use the liability to fire against the building and operation of large central stations is as unreasonable as to advocate small ships in preference to large ones, because ships are liable to sink and a less number of lives are lost when a small ship goes down than when a large one, with its load of passengers goes to the bottom of the ocean.

Or we may compare the case to a train going down an embankment or colliding with another. The larger the trains are, the greater the damage, etc. But a company that would run small trains on that account would soon get left.

One of the characteristics of Americans is that they do everything on a large scale. And no doubt they will go ahead in building large electric central stations. To do otherwise would be to go backwards.

MECHANICAL POWER.

(Continued.)

2ND PRINCIPLE OF LEVER.

In the second principle of the lever, the power is at one end, the fulcrum at the other, and the resistance to be overcome somewhere between them.

Rule.—Multiply the length of the lever by the power, and divide the product by the short arm; the quotent is the resistance overcome.

Example 1.—The length of the lever is 8 inches, with a power equal to 3 pounds acting at one end; what resistance will this power overcome, the short arm being 1 inch?

Lever 8 inches.
Power 3

Short arm 1 / 24

24 pounds resistance.

Example 2.—The length of lever is 7 feet, the power is 125 pounds, the short arm is 12 inches, what resistance can be overcome?

Lever 84 inches.
Power 125 pounds.

420
168
84

Divide by short arm 12 / 10500 / 875 resis'ce overcm'
96
90
84
60
60

The resistance, the short arm, and power given; to find length of lever.

Rule-Multiply resistance by the short arm, and divide the product by the power; the quotent is the length of lever.

Example 1.—Resistance 20 pounds, short arm 2 inches, power 4 pounds; find length of lever.

Resistance 20 pounds.
Short arm 2 inches.
Power 4 pounds / 40

10 inches length of lever.

Example 2.—Resistance 20 pounds, short arm 9 inches, power 3 pounds; required the length of lever.

Resistance 20 pounds.
Short arm .75-9 inches is $^{75}/_{100}$ of a foot

100
140

Divide by power 3 lb / 15.00 /

5 00 inches length of lever.

The resistance, short arm, and length of lever given to find the power.

Example 1. — Suppose you wish to raise 800 pounds, the lever is 10 feet long, and the short arm is 2 feet, what power required?

Weight or resistance 800 pounds.
Short arm 2 feet.

Divide by length of lever 10′ / 1600
160

Example 2.—If you wish to load the safety valve of a boiler to "blow off" at 40 pounds, with a lever 10 inches long, the short arm being 2 inches, what must the weight be?

Resistance 40 pounds.
Short arm 2

Divide by lever 10 / 80

8 pounds.

The power, length of lever, and resistance given to find short arm.

Rule.—Multiply length of lever by the power, and divide that product by the resistance; the quotent is the short arm.

Example 1. Length of lever 4.5 inches, power 2 pounds, the resistance 12 pounds; required the length of short arm?

Lever 4.5 inches.
Power 2 pounds.

D'v'd by resistance 12 lb / 9.0

.75 inch short arm.

THE DOCTOR.

USEFUL MULTIPLIERS.

For the circumference of a circle, multply diameter by 3.1416.

For the diameter of a circle, multiply circumference by 3.1831.

For the area of a circle, square the diameter and multiply by .7854.

For the side of an equal square, multiply diameter by .8862.

For the surface of a ball, multiply square of diameter by 3.1416.

For the cubic inches in ball, multiply cube of diameter by .5236.

EXPLOSION BARELY AVERTED.

Russel Sage was saved from being annihilated by the explosion of the madman's bomb as by a miracle. And from a newspaper clipping sent us by Cor. Engr. Baumgartner, of Silver State Council, A. O. of S. E., Denver, Colo., it appears that a store was saved from being blown up in consequence of the mad capers of a water corporation, at Denver, as if by a miracle also. Here is what a Denver paper says:—

The service pipe which supplies the boiler in A Z. Salomon's dry goods store on Sixteenth street, with water from the Denver Water company's mains, was disconnected last night about 6 o'clock by employes of the company.

As a result the water in the boilers became almost exhausted, and but for the prompt action of Mr. Woodruff, the engineer, in drawing the fires and opening the safety valve, an explosion would have resulted. Mr. Salomon was seen by a reporter for *The Sun* and told the following story of the affair:

This is one of the most outrageous things a corporation ever perpetrated. There were about 100 customers in the store at the time, and if an explosion had occurred many of them would have been killed.

"I told the water company sometime that I would have to quit taking their ago water, and they came down last night without notifying me or the engineer shut off the boiler supply. Of course the engineer knew nothing of the company's actions, and went along with his work as usual. But the low water whistle blew shortly after 6 and he knew something was wrong. He rushed to the gauge and found the water very low. The injector was working all right, but no water seemed to enter the boiler.

"He realized that something was wrong and at once opened the safety valve and drew the fire. Five minutes longer and the store would have been blown to atoms and several persons killed.

"I cannot understand why the company played me such a dirty trick and I do not think that any corporation should be permitted to put the lives of so many people in danger. Of course I quit taking their water, but I did so upon the recommendation of my engineer. He told me a week or so ago that the Denver company's water was ruining the boiler and that unless I changed, the boiler would last no time. I did not think the water could be as bad as the engineer said it was, so I had the boiler opened last Sunday and I examined for myself. The engineer was right. The sides of the boiler were lined with a scale from a quarter to a half an inch thick and it smelled bad.

"When I became satisfied that the boiler would be totally destroyed if the use of this water was continued, I notified the Citizen's company to connect their pipes. They were going to do this tomorrow, but if our engineer had been called out for a few minutes as he often is, there would have been no building left to connect water pipes with."

A BOILER EXPLOSION.

Fort Madison, Ia., was alarmed by a boiler explosion, Dec. 4, which occurred at the Fort Madison Paper Company's mill. It was a 50 horse-power boiler that went up, and the explosion was heard over a radius of a mile or more. Two of the firemen were hurled with the roof and walls of the boiler-room forty or 50 feet, neither being killed. It is thought both will recover. The explosion caused a fire, which was subdued. Both fire and boiler insurance were carried.

OUR FRIENDS.

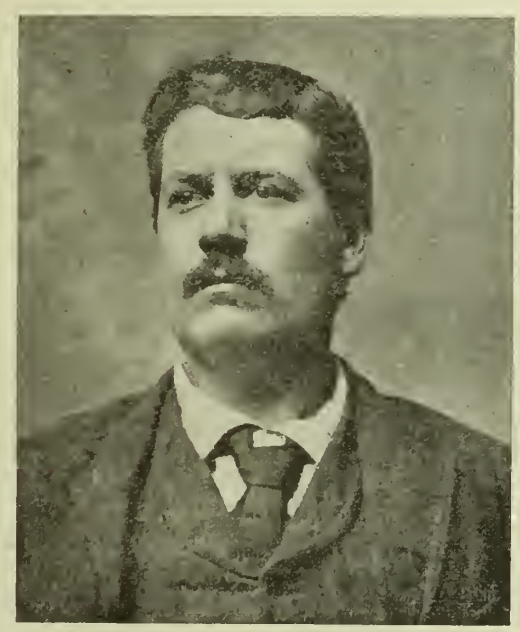
VI—JOHN J. WILSON.

The American Order of Steam Engineers hold Bro. John J. Wilson in high esteem. He organized the famous David Gilbert Council, of Omaha, when he was Deputy Supreme Chief Engineer of the state of Nebraska. He now holds the office of Supreme Senior Master Mechanic in the Supreme Council of the order, being appointed to that position at the A. O. of S. E. convention in Syracuse last summer.

We have much pleasure in presenting Mr. Wilson's picture herewith. His features indicate great intelligence, and contentment. His "pedigree" is as follows:

He was born near Fremont, Ohio, January 5, 1861. He will therefore be only 31 years of age on the 5th of next month. When ten years of age John's parents moved west, and then he began life in the Indian and cowboy country. When thirteen years old his mother died, and from that time on he had to "paddle his own canoe" and fight the battle of life for himself. At the age of 15, he began the study and handling of machinery of various kinds. He "never spent but a very few months in school," and that before he was thirteen years of age. In that respect he is similar to the great Thomas A. Edison, for the "wizard" was only two months in school altogether, and that when he was very young.

Mr. Wilson is also much of an electrician, and for the last ten years (that is since he was 20), he has



JOHN J. WILSON.

devoted most of his time and studies to steam engineering and electric light work. During that time he has been in the employ of railroad companies, water works corporations, and electric light companies. His time is now occupied in construction and repair work of steam, water and electric machinery.

To make up for his short time in school, or rather in place of school education, Mr. Wilson has been diligent in educating himself. He is a subscriber for, and constant reader of the principal mechanical and electrical papers. And he has accumulated a very excellent library on steam engineering—in fact his is considered about the best mechanical library in the state of Nebraska. He also possesses several good instruments pertaining to his adopted profession, and is an expert in the use of the indicator, the planimeter and thermometers.

As the head of the firm of John J. Wilson & Co., successors to Wilson & Perry, Wahoo, Neb., he has gained an excellent reputation as engineer, machinist and steam fitter. He is generally acknowledged as one of Nebraska's best engineers.

In another part of this issue Mr. Wilson presents our readers with the description of a line holder for engineers which he has devised.

The creature having the greatest number of distinct eyes is the chiton, a species of mollusc, in the shell of which have been found as many as 11,000 separate and distinct eyes!

MECHANICS MADE EASY.

By PROF. F. A. SMITH.

(Continued.)

If a rod of white oak 12 inches long and 1 inch square in cross sections is subjected to compression, it will be crushed under a load of 1,000 pounds; if the same rod is subjected to tension, it requires 19,800 pounds to tear it in two; if it is subjected to bending, it will break under 245 pounds, and it takes 2,350 pounds to wrench it asunder. In this manner the relative strength of different classes of material under the different kinds of strains has been ascertained. It is also plain that if a rod 1 inch square and 12 inches long will break under a load of 245 pounds, that a rod having a cross-section of 8 square inches and is 12 inches long will not break until the strain is equal to 8 times 245 pounds, or 1,960 pounds; it is also obvious that as the length of a rod increase, its resistance to bending will also decrease, and if the rod with the 8 square inches in cross sections is made 8 feet long, it would break exactly under the same load as a rod 12 inches long with a cross section of 1 square inch.

In this connection it will be proper to explain the term of tensile strength, which is used a great deal in steam engineering; if for instance, a certain boiler plate it found to have a tensile strength of 50,000 lbs. it means, that a cubic inch of that metal, if subjected to a pressure of 50,000 lbs. will be crushed; therefore a square inch of the same metal half an inch thick requires only one half, or 25,000 lbs. pressure to be crushed; consequently the tensile strength of any thickness of any plate is found by multiplying the tensile strength of the metal by the thickness; if we have a boiler, the plate of which is $\frac{3}{8}$ inches thick and of 50,000 lbs. tensile strength, then the bursting strain on every square inch of surface of the plate will be $\frac{3}{8}$ times 50,000=18,750 lbs. and if this is divided by the radius of the boiler, the theoretical bursting pressure (or pressure necessary to tear the boiler) is obtained, of course this strain gives the correct pressure if the boiler has no seams, and since boilers without them are very scarce we must take due consideration of them. In double riveted seams the full plate is weakened to the extent of 30 %, therefore the actual bursting pressure for double riveted boilers must be taken at only 70 % of the theoetical bursting pressure and, and if the seams are only single riveted then the plates are weakened 44 %, and the bursting pressure of such boilers is found by taking 56 % of the theoetical bursting pressure. The safe working pressure is easily found from the actual bursting by dividing same by the safety faction.

The following table shows the resistance to fracture of some of the more common materials:

MATERIALS.	RESISTANCE TO FRACTURE. By Crushing.	By Tearing.	By Breaking.	By Wrenching
Pine timber	6,200	12,000	160	1.540
Ash	9,000	17,000	168	1,460
Oak	10,000	19,800	245	2,350
Cast iron	112,000	29,000	980	....
Wrought iron	40,000	70,000	700	....
Steel	295,000	130,000	1,918	....

If wood were as durable as iron, its lightness would make it preferable in all cases where tenacity is required, as pine, for instance, has nearly one-half the tenacity of cast iron, while it weighs only about one-tenth as much, so that for equal weights in material pine timber would show nearly four times the tenacity of cast iron. The hardiness of a solid is measured by the readiness with which it is scratched or ground away by the other harder bodies. The different degrees of the hardiness of minerals are subdivided into twelve classes:

1, talc or soapstone; 2, gypsum; 3, mica; 4, calc spar, 5, fluor spar; 6, apatite; 7, scapolite; 8, feldspar; 9, quartz; 10, topaz; 11, sapphire; 12, diamond.

The diamond scratches all known minerals, but cannot be scratched by anything, and is therefore the hardest substance in existence.

Bodies possessing the property of ductility may be drawn into wire. The metal platinum possesses this property in a marked degree, and has been

drawn into wire the diameter of which was less than 1-30,000 inch.

Malleability is the property by which bodies may be hammered or rolled into plates. The metal gold possesses this quality in so marked a degree that it has been drawn into leafs of less than 1-250,-000 inch thick.

The following table shows the relative position of the more prominent metals as regards ductility and malleability:

Ductility.	Malleability.	
	Under Hammer.	Under Roller.
Platinum.	Lead.	Gold.
Silver.	Tin.	Silver.
Iron.	Gold.	Copper.
Copper.	Zinc.	Tin.
Gold.	Silver.	Lead.
Zinc.	Copper.	Zinc.
Tin.	Platinum.	Platinum.
Lead.	Iron.	Iron.

We have already alluded to the effect which heat has upon most bodies in expanding them, and thereby lessening the force of cohesion. There are, however, permanent changes which bodies may undergo when under the action of heat. Many bodies if suddenly cooled after having been exposed to a high temperature, become harder, more elastic and at the same time more brittle than before. If steel, for instance, is raised to a white heat and then plunged into cold water, it becomes almost as hard as diamond, very elastic, but is altogether too brittle to be used for anything else but files and dies. If the operation is renewed, and the white hot steel cooled down slowly, it will become soft, with increased flexibility, ductility and tenacity. This work of proceedure is generally called annealing.

Tempering.—Steel is generally worked into any form required in the industries and arts when it is soft. It is then hardened by heating and sudden cooling, and this is done in a manner to suit the purpose for which it is intended. The effect of rapid and slow cooling of glass is nearly the same as in steel. If melted glass is dropped into water, it solidifies into curious looking drops, terminating in a thread-like tail. The drop is so hard that it can stand a pretty smart blow, but if the tail is broken off the whole mass flies into innumerable small particles with great violence. In order to avoid this brittleness in glass vessels it is carefully annealed in specially constructed furnaces where the utensils are gradually cooled down.

Heat acts upon copper and bronze precisely in an opposite manner as upon steel. If copper or bronze are cooled down slowly they become brittle, whereas if they are cooled rapidly they become soft and malleable.

When solids and fluids come in contact with each other some phenomena may then be observed which are of great importance. If, for instance, a clean glass plate is placed vertically in water, the latter will rise on each side of the plate nearly one-sixth of an inch high. This is caused by the adhesion of the water to the glass being greater than the cohesion between the particles of the water. If, instead of a plate of glass, we take a very small tube, the water will rise within the tube, and rises the higher the smaller the diameter of the tube is. This property of fluids is called capillary attraction and explains why oil will rise above its own level through the medium of the wick, which acts as a system of small tubes. It also explains why water works up to the surface of the ground, the pores in the soil acting as fine tubes. It also explains the rising of sap in plants and trees.

Solutions.—If a lump of sugar is dipped in water, the latter will rise by capillary until the whole lump is moistened; if enough water is present the adhesion of the sugar to the water will become stronger than the cohesion of the sugar, and the latter will go over into the liquid state, forming a solution. Each drop of the solution has the form of water and the sweetness of the sugar, thus proving that the adhesion between water and sugar is perfect.

The solvent properties of liquids varies considerably. One ounce of cold water will dissolve 1,000 grains of sugar, while it can hardly dissolve one grain of sulphate of lime. There are again bodies insoluble in water, which are readily dissolved in other fluids; so can resins be dissolved in alcohol; fats in ether and benzine, sulphur in bisulphide of carbon, and silver, gold and lead in quicksilver. If a fluid has dissolved as much of a solid as it can take, the solution is then called saturated, and further additions of the solid will remain in solid state.

The mechanical action of solution must not be confounded with the chemical action of certain fluids upon certain solids. If, for instance, a copper coin is dropped into nitric acid, the coin will be getting smaller, and if enough acid is present will entirely disappear. This action is entirely different from that of a plain solution, for if we have a solution of salt in water, for instance, we can get the salt in its original form simply by evaporating the water by boiling; but if we would evaporate the copper solution in the nitric acid, we would not obtain the metalic copper but a greenish salt, nitrate of copper, being a chemical compound between copper and nitric acid.

FAILS TO CONSUME THE SMOKE.

The National Electric Construction Company, of 116 Dearborn street, Chicago, is again being pursued by the Health Department on account of a smoky chimney.

The company put in an elaborate plant at No. 116 Dearborn street last August. On each boiler were three devices guaranteed to prevent smoke. The chimney smoked just the same. After the plant had been in operation a month the company was sued by the city under the smoke ordinance.

The case was tried before Justice Glennon. The company admitted that its chimney smoked, but said it had done all in its power to observe the law. The court accepted the statement and assessed the minimum fine. A new device was put on the boilers and the smoke was almost entirely abated.

There were no more complaints until the strike in the Indiana coal mines. The company had been using Indiana block coal, for which it paid $2.78 a ton. When the famine came it was obliged to obtain other coal and is now using Hocking Valley lump at $4, Youghiogheny lump at $4, and Kentucky lump at $3.75. The new coal, while superior to the Indiana block for steaming purposes, makes more smoke, and complaints were received by the Health Department of this smoky chimney. The company has been notified to abate the nuisance.

W. L. Abbott, manager of the electric company, declares that he has done all in his power to obey the law. Until the strike is settled no Indiana coal can be secured. "If the Health Department," said Mr. Abbott, "will only suggest a remedy I will be only too happy to apply it."

AN ENGINEER'S PREMONITION.

A telegraph operator on one of the single-track roads leading out of Pittsburg had an experience last week that will last him a lifetime. The young man became careless, as dispatchers sometimes will, and he gave orders for a freight and passenger train, moving in opposite directions, to go to a certain station. When the trains had started the operator suddenly remembered that they couldn't reach the place without a collision. It was too late to countermand the order, and in his agony the prespiration ran down over his face. In describing his feelings afterwards he said he lived years in the few short minutes which would decide the fate of the trains. He was startled and relieved by seeing the engineer of the freight walk into the tower. The engineer had received his orders, but when he reached a switch he had a premonition there was something wrong and he turned in on a side-track. His train was scarcely out of the way when the express thundered by.

The next day the operator went to the Superintendent of the road and told him what had happened, at the same time handing in his resignation. The manager looked at him for a moment and then said: "Go back to your work, my boy. This experience has been a lesson for you. I don't think it will occur in the future."

The telegrapher in telling the story remarked that another such fright would drive him crazy.—*Pittsburg Dispatch.*

A TRANS-ATLANTIC BOILER EXPLOSION.

Continued from Page 235.

any of the fittings. Before being sent to Falmouth it was examined by Mr. Norton, Captain Pearce's engineer, and was then in good condition. On its arrival at the scene of the wreck it was given into the charge of Mr. Rusden, an engineer of Falmouth, who deputed certain persons to attend to to it. A fortnight afterwards the tauts and winch were washed overboard in a gale, but the boiler remained on deck and did not sustain any serious damage. It was subsequently sent to the works of Messrs. Cox & Co., engineers, Falmouth, who effected the slight repairs that were necessary, and it was then placed on the wreck. It was cleaned out from time to time, and was then examined by Mr. Rusden. The tank fed the boiler with fresh water, though salt water was used at times.

Mr. William Heath, an inspector of the Manchester Steam Users' Association, said he had been employed by the Association 13½ years, and had served his apprenticeship as a boilermaker. He gave particulars of his examinations, and of the general condition of the boiler, as well as a description of the various fittings. The firebox was slightly wasted by corrosion at the base, but this being local it was not sufficiently important to in any way effect the safety of the boiler at 70 lb., for which pressure he considered it suitable when he last examined it.

Mr. George McDonald, inspector to the Steam Users' Association, said he had served his apprenticeship with Messrs. Richards, Aberdeen, and had also had some experience as a marine engineer. He gave particulars of his last examination, and said he should have no hesitation in working the boiler at 70 lb. There was a ferrule then soldered on the spring balance of the open lever safety valve. The slight corrorison of the firebox did not affect the safety of the boiler at the pressure.

Mr. Lavington E. Fletcher, chief engineer to the Steam Users' Association, referred to the constitution of the Association.

Its object, he said, was the prevention of explosions, the saving of life, and the dissemination of scientific information for the public good. The boiler came under inspection in 1884. The pressure was first fixed at 80 lb., and subsequently it was reduced to 70 lb. The calculated bursting pressure when the boiler was first guaranteed was 275 lb., and this was not materially reduced when the last certificate and guarantee were issued. Witness read extracts from the various reports issued by the Association to Captain Pearce, and stated that at the last "entire" and steam examinations the boiler was quite safe at 70 lb. pressure.

After corroborative evidence had been given by William Norton, engineer to Captain Pearce, Mr. Henry E. Anderson, of the firm of Anderson and Baker, the salvors of the Bay of Panama, were examined. He said that the boiler arrived at Falmouth in April, and, he thought, was examined by Mr. Rusden. He thought something was said about the safety valve leaking, but nothing about the pressure gauge being incorrect. His orders were that when anything went wrong it should be repaired regardless of cost. He did not order the lock-up valve to be taken off, nor a blank flange to be fitted after the boiler had been to Cox & Co.'s in May. He had had no complaint from the men that they could not get steam enough. He heard after the explosion that a man named Godolphin, who was engineer on board the steam lighter employed in going to and from the wreck, had a safety valve in his locker, and he had made careful inquiry as to its whereabouts, but could not find it. He had not made efforts to obtain the boiler by diving, as he did not know where to dive, and it would be useless to make the attempt, inasmuch as the boiler would be covered with sand and shells in twenty-four hours after the explosion. He appointed Mr. Rusden as general overlooker at a salary of 2*l.* per week. Mr. Chas. Rusden deposed to having served six and half years' apprenticeship to the engineering business. He was out of his time in 1862 and had been engaged at the business on and off since that time, but for some years he had kept the refreshment rooms at Penzance. He did not examine the boiler when it was first placed on board the Bay of Panama. An engineer named Izzard had charge of the boiler prior to the gale, and told

witness that when the boiler was under steam the lock-up valve leaked. Izzard took the valve off, and in the witness's presence turned it upside down and poured water into it to show him that it leaked. He did not know that the valve was put on again, but did not think it was. The other valve was also leaking, and Izzard could not get more than 10 lb. of steam by the gauge. He did not know what became of the lock-up safety valve when it was removed; he had not seen it from that day to this. When the boiler was in his charge it was never worked at more than 50 lb., and the safety valve balance and pressure gauges agreed. The open lever safety valve was, he thought, in good condition up to the time of the explosion. He saw the boiler shortly before it burst, and the water gauge glass was half full of water, but he did not look at the pressure gauge. He was hurt by the explosion and his son also. His son had been confined to his bed for six weeks in consequence. He could not account for the explosion.

Charles Williams said he had worked the boiler on the Bay of Panama for eight days. The lock-up valve was removed by Izzard after the boiler came back from Messrs. Cox's. That was done about May 25. The opening in the shell was covered with a blank flange. Izzard told him that Mr. Anderson had ordered it to be taken off, as it was leaking. After being removed it was taken on board a lighter known as the "torpedo boat:" When he saw it, the spring balance valve had nothing amiss with it, but he did not see any limiting ferrule on it. Two small washers were put on the head of the valve after the boiler came from the foundry. He considered the pressure gange incorrect, because the pointer jumped up and down.

Surveyor Bissett, who examined fragments of the boiler, saw the plates were of good average quality, and at the thinest part were at least ¼ in. thick; 5/16 in. was about the average. The bursting pressure of a boiler similar to the exploded one, with a fire-box ⅜ in. thick, would be 260 lb.; with a thickness of 5/16 in. it would be 180 lb., and ¼ in. 115 lb. He did not think the explosion was due to shortness of water, but to excessive pressure.

Mr. George Edward Brown, engineer-surveyor to the Board of Trade, also considered that the explosion was due to a pressure considerably in excess of that at which it was originally worked.

The Commissioner in giving judgment, dealt fully with the question of the appointment of Mr. Rusden as superintendent engineer, and his responsibility. After the boiler came back from the foundry, steam was got up to 50 lb. as registered by the gauge, but it was important to observe that the gauge was not tested. The Court thought the gauge should have been tested, as it was very probable that some internal derangement had resulted from the boiler being torn from the tank in the gale, and that the gauge was subsequently rendered inaccurate. It was surprising that the gauge had not been tested when the boiler was overhauled and put in order. The lock-up safety valve had been removed by Izzard, but it could not be found by the Board of Trade officials. Its disappearance was much to be regretted, as it led the Court to suppose that there was at that time an endeavour to conceal the fact that it had been removed from the boiler. That it was intended to be a permanent severance from the boiler there could be no question, for Williams had told the Commissioners that he and Izzard fitted the aperture with a blank flange the morning after the valve had been taken off. Mr. Anderson denied that he personally gave instructions for the removal of the valve, and in the absence of Izzard the Commissioners were justified in accepting his statement, but they were quite clear that Mr. Rusden knew at the time, or shortly after, that the valve had been taken from the boiler. They could not express themselves too strongly as to the action taken by Izzard in permanently removing the valve. If it was leaking it would have been a simple matter to overhaul it and make it good, and they were surprised that Mr. Rusden did not order it to be efficiently repaired, which, in their opinion, would have been very easily affected. It was perfectly clear to the minds of the Commissioners that the valve should never have been removed.

CORRESPONDENCE.

"Do Not Put All Your Eggs in One Basket!"

Editor, American Engineer:

The recent destruction of the Chicago Arc Light and Power Co., by fire, furnishes ample evidence that it is a dangerous practice to aggregate very large power, and numerous dynamos in one plant. A large number of merchants were dependent upon this company for their illumination at night, and there being no other plant that could supply the vast number of electric lights which were extinguished by this fire, we shall not be surprised if this experience causes customers to hesitate before patronizing a company that attempts to supply thousands of lights from one plant.

No other electric plant in the city is able to take on to their lines the many patrons of the C. A. L. & P. Co., for the very good reason that they all build to meet the demand that comes to them, and have no very large reserve of power and dynamos, to meet an emergency like this.

It is said that no electric plant should occupy premises that are not absolutely fire proof, we do not believe a building can be constructed for such use that is *absolutely* fire proof, and to support this opinion there is ample testimony, which is acceptable.

The lesson taught by this fire will not be lost to the gentlemen who own the stock of this company, they will do some thinking which may result in causing the company to divide their plant in four or more parts with no increase in cost of maintenance or operation.

The company estimate their loss at $550,000. That they are insured for the full amount is hardly credible, and if they are it will require many months to replace the building and machinery. The question arises, what will their customers do? That they will wait for the re-establishment of this enormous plant we cannot believe, customers must have the lights, and the other companies they call on for lights will hesitate before increasing their plants to supply lights for the short term while the ruin caused by this fire is being made good.

The old adage quoted, applies to both the company and their customers. We shall wait with some curiosity to see if the wisdom of the ancient dictum is disregarded by the company and their patrons.

THE DOCTOR.

Beet Sugar.

LEHI, UTAH, Dec. 4, 1891.

Editor, American Engineer:

I received my AMERICAN ENGINEER to-day, and among the first article to catch my eye was a communication from "One of the Boys" of Multnomah Council No. 1. After reading it all through I was attacked with a strong fit of homesickness; I want to visit the old lodge again, to see the old faces, and grasp the hand of each one in a good long shake of affection. But as this would be impossible, and as I can hardly find courage to write each one personally, I thought that what I might have to say would be of interest to all readers of the AMERICAN ENGINEER, especially as I am engaged in an altogether different branch of our profession, to my knowledge, *i. e.*, the manufacturing of beet sugar.

I take the liberty, then, of writing you hoping that you will have space and inclination to insert it in your valuable columns.

To give an idea of the magnitude of this enterprise I will tell you that I have ten 60"x16 tubular boilers; one Hamilton-Corliss tandem-compound engine with high pressure cylinder 12"x36, low pressure 22"x36; one slide valve 8"x10 for driving bone coal department, and one 12"x14 slide valve for two Brush dynamos.

I have 22 steam pumps of the Blake pattern for pumping water, juices, carbonic acid gas, and air and maintaining vacuums. Two of them are duplex, one, the main water supply, being compound duplex; they range in capacity from 1,200 gallons per minute to 100.

I have in my department, counting both shifts, 20 men under my immediate supervision; so, you see, there is not much time to spin yarns.

And now a few words about the process. The beets are flumed into the factory and caught up by a 16′ wheel elevator to be dropped into a washer which in turn delivers them to a chain elevator. This carries them to the top of the building from where they fall into the slicer where they are cut into narrow strips; they then are dropped into the cells of the diffusion battery, a massive apparatus of complex build, where under pressure of heated water the sugar is extracted from the slices; the remaining pulp dropping from the cells is carried by elevator and conveyors to cars which haul it to silos where it is stored and fed to cows to make milk for the engineer. The juice, containing the extracted sugar, passes through two calorisators to the carbonation pans where it is limed and treated with carbonic acid gas to remove most of the impurities; thence to the giant filter presses where the lime and solid impurities are filtered out, thence to carbonators and presses again; there are three sets of these. From presses to evaporators, four in number and weighing 64 tons, and then through bone black filters and to vacuum pan where the concentrated juice is boiled to crystal. Then it goes to centifrugals and granulators and finally through a screen into sacks ready for the coffee of the boys of Multnomah No. 1.

Time will not permit the description of each piece of machinery, but every one is a marvel of perfection in itself and all of American design and build. This is a purely American factory built by E. H. Dyer & Co., the pioneer beet sugar manufacturers of the United States.

We are almost through this season's run and as far as the factory is concerned, it is a perfect success, much to our joy, as hitherto all beet sugar factories have been of European make. The factory was built for a 300 ton one, but will without trouble work 350 tons of beets in 24 hours, so you see American ingenuity is still at the head, and E. H. Dyer & Co. have made a name for themselves that will not soon be forgetten in the United States.

Now, Brothers, let me hear from you once in a while and remember that I am with you in spirit at every meeting.

I have written more than I intended but could not say much less and give you a fair idea of the business.

Yours fraternally,

M. W. INGALLS.

Rochester, N. Y.

Editor, American Engineer:

A resolution was passed at our last meeting suspending August Smearing for non-payment of dues.

JOHN AITKEN,
Cor. Engr., Rochester Council, No. 8, A. O. S. E.

JEFFERSON YOUNG, JR., ARRESTED.

From the "Syracuse Times," Dec. 6, 1891.

Jefferson Young, Jr., a dealer in steam appliances at 307 and 309 South Clinton St., (Syracuse, N. Y.), has been the local manager of a Chicago firm of which R. Forsyth is President. The Chicago man came here a few days ago to investigate certain irregularities in Young's transactions, but the local manager had already disappeared with certain moneys which it was alleged he had collected and misappropriated to his own use. District Attorney Hancock issued a warrant for his arrest, and the case was put into the hands of Chief Wright. The man was found on Friday night in Rochester. He was brought here yesterday afternoon and gave bail. The complaint charges him with the misappropriation of one hundred and thirty-five dollars collected from Joseph Wallier, the confectioner on Clinton street. Late on last night other warrants were issued by other parties against Young. He resides at 211 East Castle street. His attorney in the case is W. L. Barnum.

A press telegram, December 10, says: Mr. Young is held to the grand jury, having given bail for $1,500.

THANKS TO THE STANDARD OIL CO.

The corresponding engineer of Maple City council, Adrian, Mich., writes that the Standard Oil Company have presented the council with two volumes of Roper's works, for which they are exceedingly thankful. These books are a very valuable addition to their library, and the gift is very highly appreciated by Maple City council, A. O. of S. E., No. 5, of Michigan.

ENGINEERS' LINE HOLDER.

Mr. J. J. Wilson, of Wahoo, Neb., has devised a line holder for engineers, of which the following is a condensed description:

The holder stands about a yard and a half high. It consists of a base plate, to screw to the floor, on which rests a tube standard nearly a yard high. Inside this is a sliding standard, which works like a telescope, as far as lengthening and shortening of it goes. This is held at any height desired by a milled nut that forms a chuck to hold it to the standard tube. Higher up, on this sliding rod is a fulcrum to which a swinging staff is attached, and this staff is moved either way by means of a milled thumb screw. At the top end is a milled thumb screw to raise or lower the line chuck; and near the middle of this screw is a milled thumb chuck screw by means of which the line may be brought to any plane.

This tool is not patented, and Mr. Wilson says that any engineer is at liberty to make one for his own use. As far as we know there is nothing like it for holding the crank end of a line when lining up an engine. If any further information is desired, the inquiry should be addressed to J. J. Wilson, lock box 143, Wahoo, Neb.

FIRE HAZARDS FROM ELECTRICITY.

In view of the big blaze from electric wires (short-circuiting) in Chicago, reported in our last issue, the following abstract* of a lecture, by C. J. H. Woodbury, delivered at Cornell University the 6th ult. affords interesting reading:—

There have been two methods of dealing with questions involving the insurance of elements of unusual hazard; the one being that of underwriting, pure and simple, estimating the hazard from the best data of hand and charging a rate commensurate with that risk, the correct principle being that the hazard of the whole is equal to the greatest hazard of any part of the risk.

The other method has consisted in eliminating the hazard of the more dangerous part by removing such processes to another building, or at least placing them in a portion of a building where the chances of their imperilling the whole would be controlled by special methods of construction and also by additional fire apparatus, or, in other words, bringing the hazard to conform to the rate of insurance.

The latter method is confined to class insurance of such limited range that the detailed supervision of risks can be within the personal scope of the administration of such insurance companies.

When electricity was first used for lighting on a commercial scale, no small part of the knowledge gained of phenomena was the fact that it became a frequent cause of fire, and in such unexpected ways that a general alarm ensued which would have stopped its use if electric lighting had not so completely filled a need for more light that a prohibition was out of the question. Electricity had come to stay, and the problem of its status must be met and not evaded.

Everything was new, crude and undeveloped. The leading inventors were pursuing their investigations under great difficulties, not the least of which was the lack of trained assistants. Mechanics had much to learn in the construction of the apparatus, the proper manufacturing supplies were not in the market, and the steam engines especially adapted for operating dynamos had not been made. The development of the whole business required invention, education and organization from one end to the other.

Electric lighting then pertained to apparatus for the physical laboratory; now it is one of the great commercial features in the business world, reaching in all its applications in the United States to investments estimated by Lieut. Allen R. Foote special agent United States census, to be $232,202,850 out of a total of $552,202,850 invested in electrical enterprises, and divided as follows: Telegraph companies, $125,000,000; telephone companies, $100,000,000; isolated lighting plants, $6,000,000; central station plants, $155,202,850; electric railways, $70,000,000; fire alarm and police patrol, $10,000,000; steamboat plants, $1,000,000; sundry industries $10,000,000; manufacturing, $75,000,000.

The introduction of electric lighting in this country was followed by numerous fires caused by this new method of illumination. After the disturbance incident to the first scare, careful investigations were made into the subject, the greatest result of which was the establishment of the opinion that the elements of excessive hazard were not necessarily inherent in such applications of electricity. In other words such fires were to be classed as preventable fires within the limits of ordinary practical means; and on this basis the rules for electrical installations were first prepared, only to be followed by other rules drawn up by various parties to apply to new conditions for the use of electricity for the transmission of power and alternating currents, as well as to improvements in both arc and incandescent lighting.

Electricity is to-day the safest method of artificial illumination. This safety is not due to the absence of possibilities of danger, but to the entirety with which these elements of danger may be held in control.

The essentials to safety consist in confining the electricity to its metallic circuits, the prevention of undue acres in switches and lamps; and the prevention of sparks or carbons falling from arc lamps; but in their applications these precautions are necessarily involved in order to meet all of the complex conditions of the apparatus used in the various applications of dynamo currents.

The danger of fire dynamo currents is almost entirely due to the diversion of a portion of the electricity from the system, and to the fact that the miscellaneous conductors forming these outside circuits are not adequate to convey the current without undue and dangerous heating. Moisture on an otherwise poor conductor gene ally plays an important part in such conversions of electricity into heat, because the small trickling of water is readily dissociated and then the resistance at the place is increased to a sufficient amount to cause the electricity to be converted into heat of sufficient temperature to ignite any combustible material in its path.

Rain water or that from ponds used for a public water supply is a rather poor conductor, but in passing over a whitewash it takes enough salt and lime into solution to become a very fair conductor, and the same applies to water used in washing floors.

It should be remembered that when a slight arc is formed it can be blown out as readily as the flame of a candle. This is seen in the air jets used to break the arcs on the commutator of a Thomson-Houston dynamo of the squirrel cage pattern. In the lightning arresters of the same system, the arc being a dia-magnetic, it is broken by the repulsion of an electro-magnet.

In case of fire the press frequently ascribe the results to electrical wires purely on presumption, without any evidences to establish the fact. Furthermore in many instances such allegations are made when the known facts or weight of presumptive evidence indicates a contrary cause: It has been fully established by the experience of the past 12 years that a well installed electric lighting plant is the safest method of illumination.

* From the *Electrical Review*, New York

STRANGE RESULTS OF BREAKING A PISTON.

Under the caption of "A Piston on the Spree" the following is going the rounds. It originally appeared in the *Northwestern Railroader*:—

A curious phenomenon recently occurred at the Frankfort shops of the West Shore Railroad, which is vouched for by the superintendent of motive power, James M. Boon, few men being better known in railroad circles.

A cast iron piston (?), 18 in. in diameter, having been worn out, was removed from an engine and thrown in the scrap pile. Some time afterward it was taken from the pile with other scrap and being too large to use in the cupola, was carried to the breaker. On being struck it broke in two parts and immediately began to act in a remarkable manner. The iron turned to a red-heat, and from that to a sparkling white, while from the hollow parts a flame arose to the height of three or four feet, throwing out sparks as though it were filled with damp gunpowder.

The man who broke the piston became frightened and threw a pail of water on it, which deadened the flame somewhat, but it continued to glow and throw out sparks for some time, to the amazement of the twenty or more men who stood looking on.

J. R. Slack, the chief draftsman of the West Shore has referred the case to various scientific men, but has received few satisfactory replies.

One opinion is that cylinder oil worked into the hollow part of the piston around the plugs which filled the core holes, and under the high temperature and pressure to which it was subjected, united with some of the core sand remaining in the piston, formed a highly combustible compound which ignited spontaneously on exposure to the air.

Another theory is that the loose core sand, being thrown backward and forward by the motion of the piston, wore off a considerable amount of iron in an exceedingly finely divided condition, which ignited on exposure.

It is well known that a great many substances, iron among others, may be so finely divided that when thrown into the air they will take fire spontaneously, but it does not seem possible there could have been enough atomized iron in this case to cause the excessive amount of heat shown.

Whatever the cause may have been, the facts are as stated above, and, as far as we know, it is the only case of the kind on record; and any solution of what has proved so far a complete mystery will be gladly received for publication.

JETTY CONSTRUCTION.

A paper was read before the Liverpool Engineering Society last month, by Mr. John J. Potts, entitled "Notes on screwing cast-iron and driving greenheart piles at St. Anne's-on-the-sea, Lancashire."

These notes were taken during the reconstruction and completion of the jetty (of which the piles form a portion) for the landing of passengers from the excursion steamers, situated at the outshore end of the Promenade Pier at St. Annes. Borings on the site showed that hard clay was reached after from 8 ft. to 11 ft. of compact sand and gravel had been sunk through. The screw piles which are all open hollow cast-iron tubes with screwblade at bottom end 3 ft. diameter and 6 inches pitch were screwed through the sand and gravel into the hard clay. A description was given of the gear employed, and the precautions taken, it being tide work, for getting both the upright and raking piles to the required depth, also particulars of the mode of working, the number of men necessary for each arrangement of the gear, the time spent in screwing, the rate of progress, and the power developed in screwing the piles down.

Owing to the nature of the foreshore, it was arduous work screwing the piles in place, and the difficulty was increased where the capstan had to be reduced in diameter on account of the existing columns in the original structure being in the way.

The piling engine for driving the greenheart piles was of the usual construction, the top being of cast-iron and weighing 19½ cwts. Particulars of the mode of working and of the behavior of the piles during driving, with the precautions taken for preventing the piles splitting, twisting, etc., the time occupied in driving and the number of men employed were also given. These piles, being driven from above high water level, after once being pitched, it was not such tedious work as with the screw piles.

WHO WILL BE THE WINNERS?

The American Engineer Publishing Co., with the view of bringing up the circulation of the paper to fully 20,000 copies each issue, offer a premium of $40 to the one who will send in the greatest number of new subscriptions, $20 to the one who will send the second greatest number, and $10 to the one who sends the third greatest number of new subcriptions, by January 1, 1892.

Of late naturalists have been making some investigations among devilfish, and among other curious things they have found that at the same time of birth that terrible creature is not larger than a common flea.

THE WOMEN'S DEPARTMENT.

The Matrimonial Bonds.

Editress, American Engineer:

I have scarcely had time to read our department in the American Engineer, for there has been a good deal of sickness in our neighborhood. But I am delighted with the Women's Department.

I was very much surprised to see in a recent number an extract from one of Robert Ingersoll's slick, gilt-edged sermons, in which he barefacedly bids for the admiratton of the softer sex. He flippantly speaks of the bondage of matrimonial slavery. Let me tell you, truthfully, that I believe in women wearing the bonds of matrimony cheerfully, obedlently and lovingly, acknowledging man to be the head of the family, the oak for the vine.

Let me not be misunderstood. In so speaking, I do not mean that man should be continually asserting himself as the foreman of the home, and feeling that all under his roof must yield to his iron will with fear and trembling. But each and all of the family should work together for the common good, and have the same interest and aim for each other's happiness. In so doing there would be no henpecked husbands, no enslaved wives, no punishing quarrelsome children.

What I admire in a husband is strength, self-reliance, cheerfulness—a good natured man whom the children run to meet. When the children feel glad that the father and head of the family has come home, that always makes the wife feel cheerful and lightens the cares of the day. It does not matter what our cares and troubles may be if we have a good and faithful husband to sympathize with us, one who looks up to the wife as star of the household and an administering angel in this grand play of life.

It is rather unfortunate when the husband is only the nominal head of the family. But occassionally the wife is the superior half and has better ability to manage affairs. But the most natural state of matrimonial life is where the husband is the real head of the home.

Mrs. Frank Peerman.

"Silence Is Golden."

A woman, to be most agreeable, must listen, says Kate Field. Keep a man wound up, look as though you were hanging on his lips, and he'll think you charming. For my part, I like to listen. It's a great deal better fun to make others talk than to talk one's self. The listener never makes a fool of herself, because she says nothing. She cannot make enemies by the expression of opinion, for she expresses none. She learns a deal about other people, and nobody learns anything about her. She gives no offence by egotistic assertion. The talkers call her sympathetic because she has allowed all to have their own way. I don't say that a woman should everlastingly hold her tongue—there are men who insist upon an interchange of ideas; but it is always safe to start a man upon the subject of himself. Nine times out of ten you will touch the responsive chord and be entertained, as everybody can talk well on what is nearest the heart.

"You've made an impression on Mr. Randall," said Bob this morning. "He thinks you remarkably intelligent. What do you say to him?"

"Nothing," I replied. "I asked an occasional question and listened. He talked about himself."

A woman may serve up wit or epigram as an entremets, and be liked; but I am convinced that a woman who monopolizes conversation is doomed to be hated. Women in society is to be, man is to do. Beyond all other horrors are the shop-talking horrors. A woman may translate Homer, write Romola, edit a newspaper, conduct important business, or act Lady Macbeth, but she must forget herself if she wants to be welcome in society. In fact, if a woman who is not born unselfish let her assume the noblest of all virtues, and, provided she dresses well, she will be admired.

An old maid's assurance company for women has been opened in Denmark. Spinsters can assure themselves by a small sum on reaching the age of thirty, and if still unmarried at forty are entitled to a regular allowance. If they marry, however, they forfeit all claim.

The Seven Ages.

All the world's a wardrobe,
And all the girls and women merely wearers.
They have their fashions and their fantasies,
And one she in her time wears many garments
Throughout her seven stages. First, the baby,
Befrilled and broidered, in her nurses arms,
And then the trim-hosed school-girl with her flounces,
And small-boy scorning face, tripping, skirt-waggling,
Coquettishly to school. And then the flirt,
Ogling like Circe, with a business œillade,
Kept on her low-cut corset. Then a bride,
Full of strange finery, vestured like an angel,
Vailed vaporously, yet vigilant of glance,
Seeking the woman's heaven, Admiration,
Even at the altar's steps. And then the matron,
In lair, rich velvet, with suave satin-lined,
With eyes severe and skirts of youthful cut,
Full of dress saws and modish instances,
To teach her girls their part. The sixth age shifts
Into the gray, yet gorgeous, grandmamma,
With gold pince-nez on her nose and fan at side,
Her youthful tastes still strong and worldly wise
In sumptuary law, her quivering voice,
Prosing of fashion and LeFollet, pipes,
Of robes and bargains rare. Last scene of all,
That ends the sex's Mode-swayed history,
Is second childishness and sheer oblivion
Of youth, taste, passion, all—save love of dress.

—*Burlington Enterprise.*

There Was a Man.

There was a man was half a clown,
It's so my father tells of it!
He saw the church in Clérmont town
And laughed to hear the bells of it.

He laughed to hear the bells that ring
In Clermont church and round of it;
He heard the verger's daughter sing,
And loved her for the sound of it.

The verger's daughter said him nay;
She had the right of choice in it.
He left the place at break of day;
He hadn't had a voice in it.

The road went up, the road went down,
And there the matter ended it.
He broke his heart in Clermont town;
At Pontgibaud they mended it.

—*Hailaire Belloc in St. Nicholas.*

She Saved Her Friend's Life.

A young English girl, Miss Blanche Hays, has been awarded by the Royal Humane Society an honorary testimonial on vellum for saving the life of Miss Saunders at Oddicombe June 17. Oddicombe is a small unfrequented bay between Dawlish and Torquay, where, the morning in question, Miss Hays was bathing, in company with Miss Saunders and another friend. The shore shelves suddenly down several feet, and it thus happened that Miss Saunders, after taking a few steps, unexpectedly found herself out of her depth. Miss Saunders, who was quite unable to swim, exclaimed "I am drowning!" whereupon Miss Hays, without a moment's hesitation, swam out to rescue her. It was only with much difficulty that Miss Hays brought her companion ashore, for Miss Saunders made the common mistake of seizing her rescuer by the throat instead of around the waist, and, being a much bigger person, Miss Hays nearly sank beneath the weight. There were only a few persons on the beach at the time, and Miss Hays believed that the event had passed unnoticed, when the next day, to her great surprise, she was accosted by one of the fishermen of the place, who complimented her upon the bravery she had displayed. The testimonial which the society has bestowed takes the form of an album, in which is inclosed a parchment document bearing a record of the heroic deed. Miss Hays is naturally very much pleased at an act of recognition which she was much too modest to expect. It is an interesting fact that she has since succeeded in teaching Miss Saunders to swim an act of which she herself has been a master ever since she can remember.

A Domestic Episode.

She stood at the glass with a glowing cheek,
And looked at the face reflected there,
And thought that the mirror, if it could speak,
Would say she was very sweet and fair.

As she turned with a smile to her husband, he
Remarked, and his tone conveyed a sneer,
"It pleases you very much, I see,
To look at yourself in the glass, my dear."

She had learned the art of keeping cool,
So she answered him in a gentle tone;
"I'm glad to know I am beautiful
For my husband's sake and not my own."

A flush of shame his face o'erspread
And crossing over to where she stood
He kissed her warmly and softly said,
"You are more than beautiful—You're good."

—*Somerville Journal.*

Helpful Home Hints.

Zinc is best cleaned with hot soap-water, then polished with kerosene.

In using an egg-beater do not hold it in one place; move it round in the bowl.

Salad is much easier served and much more appetizing when placed in individual plates.

Oilcloth can be kept bright for years if properly varnished each season with any good siccative.

If troubled with headache try the simultaneous application of hot water to the feet and back of the neck.

Tubs will not warp or crack open if the precaution is taken to put a pail of water into each directly after using.

Yellow spots on the linen or cotton produced by the iron may be removed by setting them in the broiling sun.

Fried fish is very good turned in salted flour, or salted egg and bread crumbs, and then put into boiling hot fat to get brown.

To clean a teakettle take it away from the fire and wash off with a rag dipped in kerosene, followed by rubbing with a dry flannel cloth.

In washing blinds and dark paints always add several tablespoonfuls of ammonia to the water, and when dry rub the paint with kerosene oil.

Old carpets may be made into rugs by unraveling them and weaving the ravelings on frames which come for this purpose, or knitting them.

A simple cement for broken china or earthenware is made of powdered quick-lime, sifted through a coarse muslin bag over the white of an egg.

To keep eggs fresh as soon as they are taken from the nest rub them entirely over with butter and put them in a cool place, and they will keep good for months.

A remedy for creaking hinges is mutton tallow rubbed on the joint. A great many locks that refuse to do their work are simply rusted and will do all right if carefully oiled.

To make tea do not use water which has stood in the teapot and been boiled repeatedly. Fill the kettle with fresh water and use it just as it comes to the boiling point.

In the Medical Profession.

In the United States there are not less than three thousand women doctors, of whom about five hundred are practicing in New York. The first one was Miss Blackwell, who scoured the country over before she found a medical university willing to admit her. In India there are forty women doctors, but in France there are said to be only two who are exercising their calling in peace, although there are two hundred girl students now preparing to practice medicine. In Germany women may qualify, pass examinations and obtain their diplomas, but they cannot practice. In Vienna they are still worse off, because, although they are "allowed" to attend the universities, each time they appear at a lecture it creates quite a scandal. In Spain there are about half a dozen women doctors. In Roumania there are two and in Belgium there is only one.

—*Evening Lamp.*

Women as Barbers.

Arrangements made to open a shop in New York, where they shall do the work, it seems "the rumor has some foundation," said the propreter of a fashionable barber-shop in an up town hotel in reply to the query of a *New York Herald* man. "I am seriously considering the feasibility of opening a shop apart from this one and employing female artists ex lusively."

"You would engage the most attractive ones, I presume?"

"Naturally. I would get eight or ten of the hand somest and most skillful young ladies and train them myself. One of my assistants here tells me I shall be nailed to the cross if I try this thing. Nevertheless, as the feller said, you can't always generally sometimes tell."

"But don't you apprehend that a great deal of time will be consumed in flirtations between young men in the chairs and the artists?"

"I have provided for all contingencies of that nature. Everything will be under a perfect system. Each man will receive a ticket upon entering the room bearing the printed rules and regulations of the establishment. They must be observed to the letter," and with a mild relaxation of the features he handed me a card which reads as follows:

Customers are not expected to regard it as a social obligation to converse with the lady artists.

The common-places of the day—or, if it be after sunset, of the evening—are all that the proprietor expects to be uttered. The artists will be the same as deaf, dumb and blind to all young men who come here to make a mash. Every gentlemen will be treated with uniform courstesy.

Those who are not gentlemen may save themselves the humiliation of being ejected by remaining away altogether.

Ladies are peculiarly qualified to do shaving and hair-dressing more gracefully, tastefully and expeditiously than men, and it is for this reason that the proprietor has secured the services of respectable women, in the hope that their presence will lend an atmosphere of dignity and moral elevation to the barber-shop which, alas! it has not known heretofore.

"There you have it in a nutshell," went on the brainific barber. "There are plenty of women who cannot find decently remunerative employment, but who are obliged to earn a living somehow. My purpose is to introduce a female barber-shop where there will be no nonsense, and I have already hired for my head barbar a bright girl who graduated at Vassar college two years ago, and who on account of her father's business misfortunes is thrown upon the congealed world to support herself. I am giving her instuctions now in the use of the razor, and I am convinced that she will develop into a really clever barber. I have also engaged a young lady who has starred all over the country in 'Ingomar,' 'Article 47' and 'She Stoops to Conquer.' She has had a bad luck in her stellar efforts and now her ambition is to settle right down to business. She is still lovely in face and form, and I will wager she will run the most profitable chair in the shop."

"How soon will you open the shop?"

"Within the next month, if possible. At present I am selecting my help, and of course it will take some time to get just the faces I want and the ones who can readily acquire the art. If you happen to know a nice-looking girl who wants a steady job, just send her around and I will talk over the matter with her."

An "Asker."

The professional medicant doesn't care to be called a common beggar outside of business hours. A diverting story credited to Mrs. Andrew Lang brings this point into clear relief. "In the days of my childhood," she says, "a friend of my own was informed by a favorite housemaid that she wished to give warning, as she was going to be married. 'Indeed,' said the lady, 'and what is your future husband?' 'Please, 'm, he's an asker!' 'A what?' 'An asker.' 'I don't understand. What does he do?' 'Well, 'm, he—he goes about the streets, and if he sees anyone coming along that looks kind he—well, he just stops 'em and asks 'em to give him a trifle, and he makes quite a comfortable living that way!' 'Do you mean a beggar?' 'Well, 'm, some people do call it that; we call it asker.'"—*Chicago Times.*

Characteristics of Mme. Bartholdi.

One of the celebrated sayings of Mme. Bartholdi, who died on her 90th birthday, was "Do not repress badness; crowd it out with good ideas." Mme. Bartholdi was left a widow when quite young, and showed splendid business faculties in the way she managed the stewardship of her sons' estates, while she was also very careful about their education. In her girlhood Mme. Bartholdi's beauty was much lauded in Alsace. Her son was probably thinking of his mother in her youth when sketching his design for the celebrated colossal statue of "Liberty Lighting the World."

The First Woman Chemist In Paris.

Mlle. Leclerc, a student in the Paris School of Pharmacy, has just taken her first-class degree. She will be the first woman chemist in Paris, but not in France, for there is a lady established in this business at Toulouse. One unusual thing about Mlle. Leclerc is that she is of French nationality. Almost all the students who frequent the Ecoles de Medicine and Pharmacy are foreigners. Before practicing in her own name she will have to serve her time—three years—as an assistant.

LITERARY NOTES.

Messrs. John Wiley & Sons, the well known publishers of text books and industrial works, of 53 east 10th street, New York, have in preparation a *Manual of Experimental Engineering*, by Prof. R. C. Carpenter, of Sibley College, Cornell University.

Engineers Licensing Law.—Mr. Walter G. Craft, of Chicago, has issued a pamphlet (for free distribution), containing the Chicago engineers' licensing law, and other matters of interest to steam engineers.

"What is that young man's name?" "What young man, papa?" "The one who stayed till after twelve o'clock." "His name is William, papa." "Bill for short?" "I suppose so." Well, it isn't complete." "Not complete?" "No; it ought to be Gas Bill for short." And the old man went down into the cellar, and held the lantern up to the meter once more.

CONTRACTS OPEN.

Comptroller's Office,
City of New Orleans,
New Orleans, Nov. 20, 1891.

Sealed Proposals will be received at this office until the hour of 12 m., Thursday, February 18, 1892, for the construction of a new drainage pump, in accordance with plans and specifications on file in the office of the City Engineer. Copies of plans and specifications will be forwarded by mail on request.

A deposit of $200 will be required to accompany each bid.

The city reserves the right to reject any and all bids.

All in conformity with Ordinance No. 5753, C. S., adopted Nov. 10, 1891.

F21 Otto Thoman, Comptroller.

Drawbridge.—Competitive plans for a drawbridge across the Duluth ship canal will be received by the board of public works in and for the corporation of the city of Duluth, Minn., until 2 p. m. on the 28th day of December, 1891, said plans to be drawn according to notes and specifications for the size and strength now on file in the office of said board, which will be furnished upon application. A cash prize of one thousand (1,000) dollars will be paid for the best plans furnished. Said plans must be accompanied with detail specifications and approximate cost of said bridge. The successful bidder in all probability will, if so desired, be engaged by the city of Duluth when the bridge is built to superintend the building of the same.

Official Seal. Henry Truelsen, President. T. W. Abell, Clerk, Board of Public Works.

Steam Heating.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until the 11th day of December, 1891, for all the labor and materials required to fix in place complete the low pressure, return circulation steam heating and ventilating apparatus for the United States Post Office, etc., building at Jackson, Mich., in accordance with the drawings and specification, copies of which may be had at this office, or the office of the superintendent at Jackson, Mich. Bids will be considered for any other system of heating and ventilating, in lieu of the above' and parties proposing to supply such must submit, with their proposal, plans and full specification for same. Each bid must be accompanied by a certified check for a sum not less than 2% of the amount of the proposal. Proposals must be sealed and marked "Proposals for the low Pressure, Return Circulation, Steam Heating and Ventilating Apparatuus (or otherwise, as the case may be) for the United States Post Office Building at Jackson, Mich.," and addressed to W. J. Edbrooke, Supervising Architect.

DECEMBER 19, 1891. The American Engineer. VOL. 22, NO. 25.

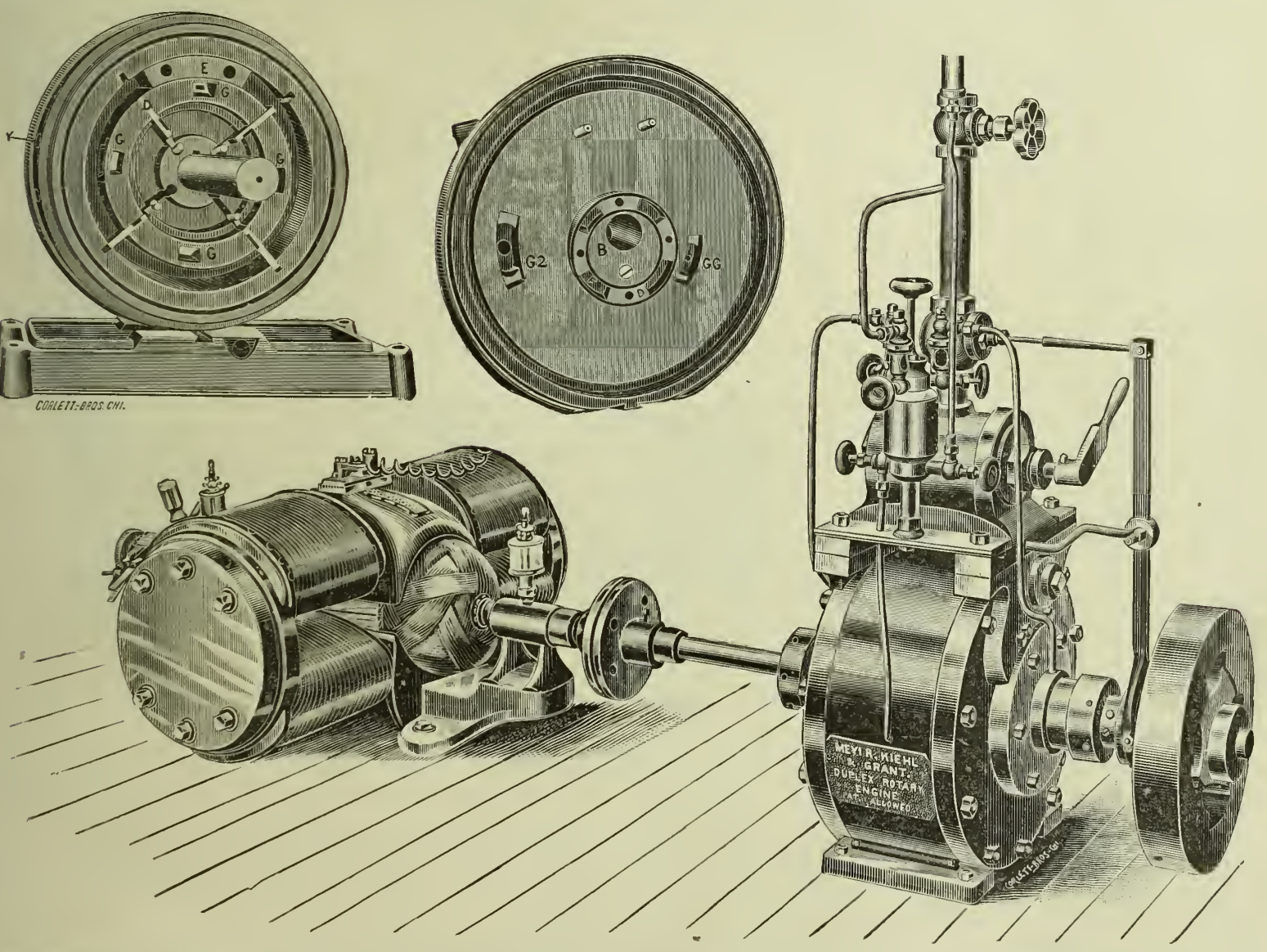
THE DUPLEX HIGH SPEED ENGINE.

The accompanying illustrations show the leading featnres of the Duplex High Speed Engines which mark a new era in the building of steam engines. The manufacturers—the Duplex High Speed Engine Co., of 215 East Superior street, Chicago, have good reason to expect that this new engine has sufficient merits to bring it into prominence very rapidly. It is well adapted for electric lighting and power purposes, especially street railway work, aud is expected to come to the front in connection with all kinds of machinery.

The engine is of the simplest form of construction, requiring little attentiou, and is so compact that no parts within can become disarranged or displaced, and is capable of running at high speed from 500 to 2,000 revolutions per minute. In the consnmption of coal it will average a saving of from 15 to 25 per cent., and wheu taken into consideration that the engine can be connected direct to the dynamos, thus avoiding friction of shaft aud counter shafts, and other shafting evils, together with largest makes. The reason of this is that, on account of the motion being continous and steady the vibration is hardly discernable. Not only is this true when the speed is normal, but even when revolving at high rate.

The expansion of steam is another marvel of invention, and something peculiar to this high speed engine. Outside of the annular space in the flange of the revolving disc are four pockets leading into the annular space of steam chamber on each side, which communicate with the port holes or openings of the stationary disc. As these pockets in the revolving disc pass the port holes of the stationary discs or side plates they get a charge of steam, which passes into the annular space or steam chamber. Striking the pistons, it passes around to the other side under the valves and exhausts, doing its work more effectively than in any other make of engine, on account of its continuous motion and the leverage obtained, which is a considerable increase of power. The lubricating is accomplished by the use of triple sight-feed lubricators, needing no attention after the cup is filled and feed adjusted. of space, durability and efficiency. It can be coupled either direct on engine shaft, or by belting. And taking their No. 12 sizes, the dimensions of space and capacity are as follows: Floor space 18x36; height 20 inches; diameter of cylinder and stroke 6x10; number of revolutions 300; gallons of water, 14,000.

Those who have used the duplex high speed engine speak very highly of it. And the Duplex High Speed Engine Co. have received very flattering testimonials. We here give two or three of the latest, as specimens:



Chicago, Nov. 14, 1891.

Duplex High Speed Engine Company.

Gentlemen: Having used your Dnplex High Speed Engine in connection with the Thomson-Houston Electric Company's dynamo for the purpose of lighting our miniature of Clarkdale during the Exposition this year, we can and do feel like saying many words in its behalf. Its compactness, its power, to wit, an eight horse power doing the work of a twelve, its direct connection with dynamo, etc., lead us to feel that too much cannot be said in its praise. We do therefore cheerfully recommend your engine as one worthy of investigation by any one who may be in need of mechanical power. Yours truly,

WALLACE G. CLARKE & CO.,
411 First National Bank Bldg.

We heartily indorse the above statement.

CLARK & FINDLAY,
Designers and Builders of Miniature, Clarkdale.

The Thomson-Houston Electric Co.,
Isolated Electric Ligting Department.
Chicago, Nov. 25, 1891.

Duplex High Speed Engine Company.

Gentlemen: I take pleasure in testifying to the fact that your engine installed in conuection with our dynamo for the lighting of the Clarkdale Miniature Subdivision at the Exposition recently proved to be entirely satisfactory for the purpose. There is no question but that an engine of this kind, which can be coupled direct to the dynamo, will the fact that only enough engines need to be run to do the work, by this means avoiding long runs under loads so wasteful to fuel, it will be clearly seen that it commends itself for its simplicity, economy, durability and power.

The workmanship and materials used are of the very best, and each engine is subjected to a most exhanstive test before being offered for sale. The governor valves and governor regulating the speed of the engine are so nicely balanced, without the tendency to over-sensitiveness, that the speed of the engine can be governed within one per cent. for all changes of load from zero to full load, and any motion desired can he obtained with certainty; and by the operation of the rotatory valve, the movement can be easily and quickly reversed without the slightest injury resulting. Another point of advantage which these engines have over any that have heretofore come to the attention of the trade—and all will concede its importance—is the fact that it requires no special foundation, not even for the This engine being adjusted by straight bar with right and left hand screw.

It has been proclaimed to be the engine of the future by persons of known reputation and competent tojudge. It will interest power users in general, street railway and electric light station men in particular, to investigate its merits.

The Duplex High Speed Engine Co., besides introducing its most efficient engine, also makes a perfected rotatory pump. The engine and pump, as regards their construction, are similar in every detail, and by a cleverly arranged re-adjustment an engine can be converted into a pump, and *vice versa*.

To demonstrate the wonderful power of the pump, a five horse power duplex high speed engine was coupled direct to a pump with a cylinder measurement of 66 cubic inches, and showed a capacity of pumping 143 gallons per minute, thus showing it to have made 500 revolutions in that time.

The duplex pump is remarkable for its economy

prove a great advantage in many cases. Yours very truly,

Jas. A. Johnson,
Manager Isolated Lighting Department.

State Board of Agriculture.
Mount Carroll, Ill., Nov. 28, 1891.
Duplex High Speed Engine Co.,
215 E. Superior St., Chicago, Ill.

Gentlemen; I desire to say that your High Speed Engine used at the American Dairy Show to furnish power for the working Dairy, proved a perfect success for economy of space occupied, and a steady motion. Your engine is unsurpassed and I can recomend it as an engine for Creameries in running separators or any other work where high speed is required. Yours truly,

A. B. Hostetter,
Supt. American Dairy Show.

SMOKE ABATEMENT IN CITIES.

The smoke question was "thrashed out" at the Engineers' Club of Philadelphia, Dec. 5.

The Secretary read a paper by Mr. George R. Ide, of which the following is an abstract:

The principal objections to smoke are that it gives everything in the neighborhood a disagreeably smutty appearance, that it renders the atmosphere unpleasant to breathe, and that it produces injurious effects on vegetation. The loss of fuel is probably not greater than one per cent. There are three systems of supplying fuel by hand—the spreading system, the coking system and the alternate side-firing system. A great amount of care is required with any system of hand-firing, to prevent the formation of smoke; much more than can usually be exercised. The coking system is as old as 1800, when a patent was granted in England for such a system. In the United States since that time there have been probably, 1,000 patents granted for contrivances of this nature. In all or most of these contrivances the principle is old, but embodied in various forms, and many of them are successful in preventing the formation of smoke in objectionable quantities. The principal reason why a more general use is not made of these devices is their first cost and the fact that some one else is inconvenienced. Few cities have any regulations on the subject, and those that have do not enforce them, for fear of driving away manufacturers. The report of the Philadelphia Smoke Abatement Committee in 1882 shows that by the use of improved designs of furnaces and methods of operating them the smoke nuisance may be practically done away with, and that the use of mechanical stokers is of the greatest importance in producing this result. The abatement of the smoke nuisance, so far as steam boilers are concerned, does not depend upon the possibility of designing suitable new appliances, but upon that of inducing proprietors to use the appliances long since designed.

The following letter was read:

H. W. Spangler, *Chairman.*

Dear Sir:—I have considered the matter referred to in your kind favor of Oct. 13, in reference to stopping smoke, etc. I regret that I have not at present a means to suggest to prevent this trouble. I have no doubt, however, that it is perfectly practicable in many instances, as smoke means simply imperfect combustion. Design a more perfect method of burning coal than that ordinarily in use now, and the smoke or unconsumed carbon will be burned, giving an increase of heat and consequent power. Yours truly,

Russell Thayer.

The subject of smoke prevention was discussed by Messrs. George S. Strong, Max Livingston, H. W. Spangler and T. Carpenter Smith, members, and by Messrs. John D. Baltz and Walter C. Kerr, visitors.

Mr. Strong believed that the public was not yet educated up to the conviction that smoke prevention was a possibility. He found that railroad managers took little interest in devices for the purpose, however successful, unless forced by competition with non-smoke producing roads. When fire-bridge walls are provided with openings in the back, these soon become clogged with slag. Air must be supplied under the grate.

Mr. Livingston said every effort had been made in Pittsburg to abate the nuisance; but the trouble always in the way was that smoke prevention cost more than it came to. The proper remedy is first to convert the soft coal into gas, and then burn the gas.

Mr. Spangler, for the Committee on Information, called attention to the device used in Chicago & Alton engines, and mentioned an inventor who tried the plan of fanning the smoke back into and through the fire.

Mr. Baltz referred to the residences on "the bluff" in West Philadelphia, where the smoke from the Penna. R. R. locomotives passing around the bluff immediately under the houses, comes in the cellar windows and into the hot-air flues of the furnaces and is thus introduced into every part of the house.

Mr. Kerr said that mechanical stokers may, if desired, be so manipulated as to prevent the emission of smoke. Referring to Chicago, he said the difficulty there lay in the low setting of boilers put up in past years, and the consequent difficulty in introducing sufficient air below the grates; the water in the ground preventing the introduction of proper air ducts below the boilers; but if there is anything that popular feeling can do in the premises it will be done in Chicago between this and 1893.

The successful devices depend upon the supply of a great surplus of air, which of course means mere dilution of the smoke and must be accompanied by a loss of sufficiency, and this has brought smoke-consuming devices, as a class, into disrepute.

Mr. Smith had had some experience with mechanical stokers, of the continuous chain grate pattern. They reduced the smoke, but were found costly in repairs, and were abandoned. Mr. Smith referred to the use of deep copper fire-boxes and of fire-bridges on English and Scotch locomotives.

Mr. Kerr remarked that such devices were useful on locomotives, but could not be applied to stationary engines. In locomotives the bridge reduces the excess of draft. In stationary engines there is a deficiency of draft to start with.

Mr. Morris referred to the work of Charles Y. Williams, published in 1842, as containing pretty much all that is known to-day on the subject, and which summed up the matter in the conclusion that smoke prevention does not pay.

The Secretary read a paper by "an ex-Member of the House Committee," dealing with the problem of suppressing or mitigating the emission of smoke during the meetings, to the annoyance of some of those who failed to contribute their quota to the Club out-put. It was noted that upon submitting the question to vote upon a previous occasion the verdict was 101 to 100 against prevention.

A splendid exhibit from Australia seems assured. Minerals, education, forestry and especially wool are to be represented. Wool growers and wool brokers, to the number of fifty, met recently in Sydney, New South Wales, and took steps to make at the Exposition a very extensive collective exhibit of wools. New South Wales has selected its commission to the World's Fair.

GOVERNOR PERFORMANCE AS RECORDED BY SCOTT'S NEW ELECTRIC REGISTER.

It is commonly believed that certain kinds of work are most severe on an engine, because of the variable character of the load. This is not true, however, to the least degree, as observed by the Westinghouse Machine Co,, since the engine accepts only the reciprocating pressures distributed by its valve, and no change of load can make these changes of pressures more numerous or violent than would occur under constant load. A change to a longer cut-off, they say, merely continues the pressures through a greater part of the stroke; while a shorter cut-off has no effect in making the reversal of pressures less sudden at the end of the stroke.

The real trouble experienced is an acknowledged inability, in the great majority of governors on the market, to effect a perfect adjustment for quick changes of load without being affected by the violent surging which generally occurs. When subjected to this strain they rapidly deteriorate with their effort to satisfy the demands upon them, while obstructing devices which insure a smooth, easy action of the governor have the very opposite effect upon the engine and the work it does.

Probably the severest duty imposed upon an engine governor is found in electric railway work, where the changes of load are practically instantaneous, and often through a wide range, while the character of the service demands a constant speed.

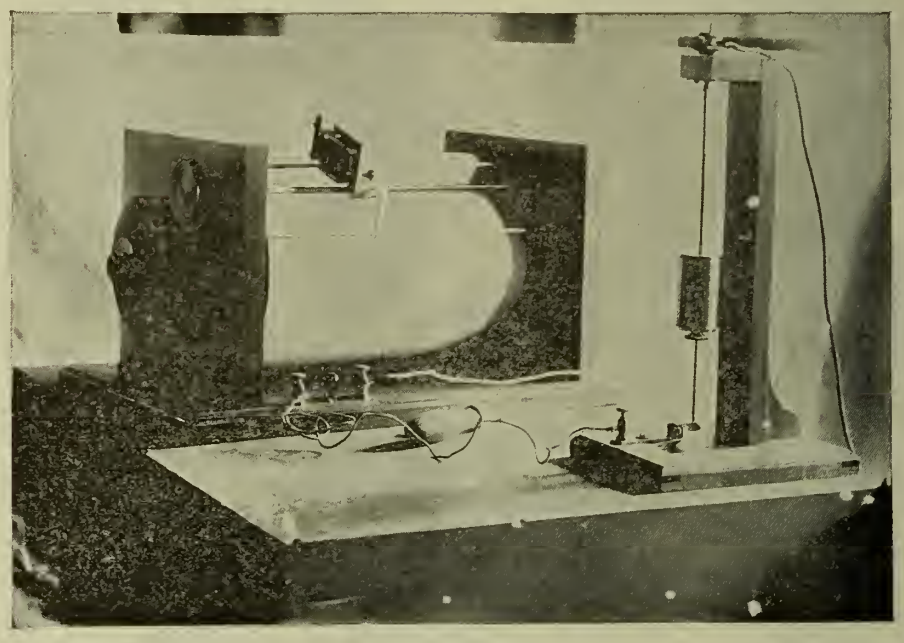


Fig. 1.

It is customary and considered sufficient in such work to measure the speed over a considerable interval of time, and the rate of speed per minute represented as the actual number of revolutions in that time; yet, extreme fluctuations of load might change the speed (even if but momentarily) far above or below this reading without in the least affecting the average.

With a view to thoroughly investigate the efficiency of Westinghouse compound engine governor in this respect, a supplementary test was made upon an 18 and 30x16 engine of this type at the powerhouse of the Federal Street and Pleasant Valley Electric Street Railway, Pittsburg, by C. F. Scott of the Pittsburg Labratory of The Westinghouse Electric and Manufacturing Company. A special instrument was designed by Mr. Scott, reading to one-hundreth of one per cent. variation of speed and registering every half second.

Following is a description of the apparatus, which is shown in Fig. 1 (herewith); milled center inserted in that of the engine's shaft revolves a large wooden drum (whose circumference is 25 inches) at the same speed as the engine (250 revolutions per minute), while a belted screw feed moves an electromagnet, whose armature supports a pencil, longitudinally along the cylinder. Another part of the apparatus is a pendulum adjusted to beat nearly at the speed of the engine and make electric contact at the center of its motion to operate the armature and pencil upon the drum. A strip of paper stretched upon the drum receives the impressions

of the pencil, and when developed displays a line of elongated dots at an angle to the edge of the paper whose inclination varies with the speed. The measured distance, in inches, of two dots that represent four revolutions of the engine, or 100 inches of the drum, is the per cent. of variation of the engine's speed from that of the pendulum; and a blotted series of these measured distances from a base line, shown in Fig. 2, with a connecting line drawn through them, is the record of the governor's performance. A horizontal distance of one square corresponds to two revolutions of the engine, or an interval of one-half second of time; while a similar vertical distance represents a change of speed of one per cent. The curve above this illustrates the change of load by ampere readings over the same period of time.

It will be seen that the engine changes but one per cent. each side of the neutral line representing the time of vibration of the pendulum through a total change of current equivalent to two-thirds of the rated power of the engine.

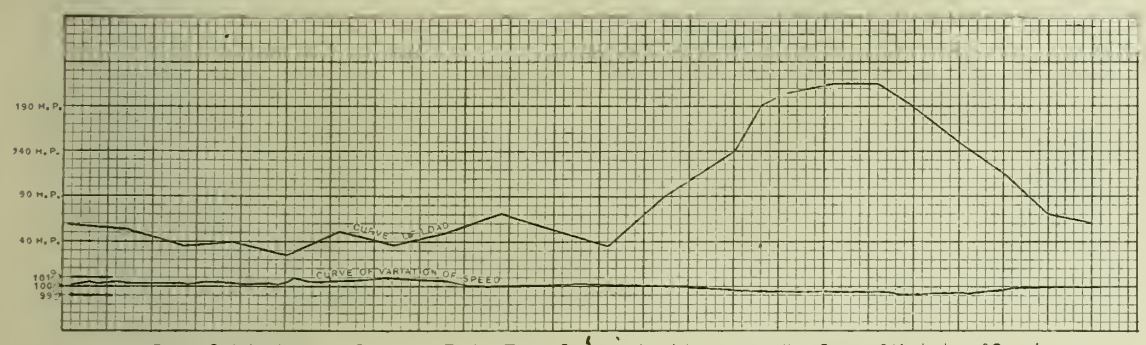


Figure 2. Westinghouse Compound Engine Tests—Curves of Load & corresponding Curve of Variation of Speed

Fig. 3 is a similar curve illustrating the action of a governor which depends upon centrifugal force alone for its change of position, as tested by this instrument during moderate changes of load. After each new load the speed changed nearly one per cent. beyond the point at which it should have settled and gradually worked back to the proper place. This governor was perfectly free from obstructing devices; yet, it is indicated plainly that adjustment did not even commence until the speed had changed considerably. However, this is not surprising when it is considered that it depends on this variation of speed for the force of adjustment. Indeed the record is not at all a bad one, so far as centrifugal governors go, and the extra momentary change of speed would never be noticed in the average service, but it would be wholly unfit for electric railway work.

In their new compound engine governor, the Westinghouse Machine Company disclaim broadly

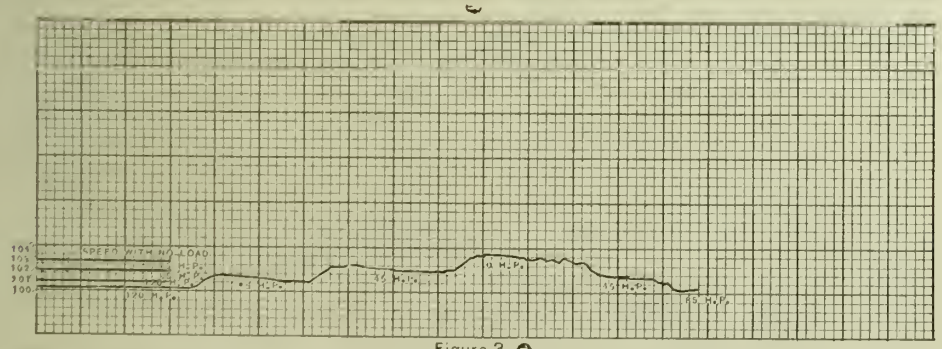


Figure 3.
Curve illustrating variations of Speed in Steam Engines whose governors are actuated by Centrifugal force alone.

the originality of the principle of inertia in shaft governing, but insist that they have been the first to so successfully apply the principle, and exhibit in these curves the evidence of the degree of perfection they have secured by the application.

St. Louis, Mo., is making considerable headway in the erection of new buildings. They are proceeding with the foundation work of the great Columbia Brewery; Otto Steifel (son of C. G. Steifel, one of the large brewers who sold out to an English syndicate), and C. Conrades (son of the well-known chair manufacturer), are the builders. This brewery is to cost $250,000; and it is worth the while of those interested to seek the contracts for boilers, engines, machinery, etc.

Sanguinite is the name for a new metal found in South America.

BURSTING OF STEAM PIPES.

A remerkable explosion occurred recently at Ligget & Meyers' tobacco factory, St. Louis. The steam pipes bursted with most disastrous effect. In describing it the *Post-Dispatch* says:

A heavy explosion aroused the neighborhood around Thirteenth and Washington avenue, at 3 o'clock in the morning, and produced considerable excitement. The shock was felt for several blocks and the report was followed by the sound of escaping steam. Investigation into the cause was at once made by several score of half-clothed men and it was found that a large volume of steam was pouring from the shattered windows of Liggett & Meyers' new boiler house and office building at 1218 Washington avenue. After roaring for five minutes the escaping steam was shut off and the neighborhood retired in a hazy state of uncertainty as to the origin of the explosion. Some asserted that a steam supply pipe had burst, others that an auxiliary to one of the boilers had blown up.

At daylight it was found that a most unusual accident had occurred. In the northeastern corner of the ground floor of the building, which is still in course of construction, a large coil of steampipes, for heating purposes, had been placed. There were twenty-five rows of pipes, four tiers deep, setting in a cast-iron base. This radiator blew up through the sudden condensation of steam, broke into three sections and scattered portions of castings in all directions. A hole about two feet square was torn in the solid masonry of the floor, all the front windows of ⅜-inch were blown out and the sashes more or less damaged.

The foundations and walls are of extraordinary thickness, the intention being eventually to add six stories to those already erected. But for the exceptional solidity of the front wall the Washington street end of the building would have been blown out. The substantial character of the construction and the existence of windows, however, saved this.

Competent persons estimate the force exerted by the expanding vapor to have been tremendous, and had the explosion occurred during the daytime, when workmen were employed in laying the floor tiling and finishing the plastering, lives would have been sacrificed. Several pieces of castings, weighing from ten to twenty-five pounds, were found twenty feet away from where the radiator stood.

The accident is explained in this way, according to our St. Louis contemporary: Steam had been turned off during the night and water had condensed in the pipes. The night watchman probably turned the steam on a moment before the explosion occurred, and neglected to open the "pip," or air valve, to permit the escape of air and permit the water to be forced into the drain pipe. The instant that the steam encountered the cold air and water the explosion occurred.

The damage will amount to about $200.

MECHANICS MADE EASY.

By Prof. F. A. Smith.
(*Continued.*)

The adhesion of gases to liquids is shown by the fact that water absorbs all kinds of gases, but the amount of gases so dissolved varies greatly for different gases, and depends also on the temperature and on the pressure under which the absorbtion takes place. For instance, one cubic foot of water at 32° above zero and under ordinary air pressure absorbs only 1-50 cubic foot of nitrogen, 1-25 cubic foot of oxygen, 68.86 cubic feet of sulphuric acid, 506 feet of muriatic acid, and 1050 cubic feet of animonia gas. If the absorption takes place under high pressure the amount of gas so taken up increases correspondingly.

The adhesion of gases to solids varies greatly with the substance of the solid as well as the kind of gas; porous bodies generally absorb gases to a considerable extent. The most prominent of these is fresh burnt charcoal which has an extraordinary absorbing power for gases; as one cubic foot of charcoal will take up about 7 to 9 cubic feet of air, 35 cubic feet of carbonic acid gas, and 90 cubic feet of animonia. It has been observed that such fresh burnt coal exposed to the air for a few days will gain 1-5 in weight caused by this absorption of gases. This property of coal makes it a valuable disinfecting medium since it absorbs noxious effiuvii which are always in gaseous form, thereby purifying air and water and in this capacity is used to a great extent.

The formation of clouds may also be explained here as caused by the adhesion of the condensing water vapors to the air where they float until the particles become to heavy and fall down in the form of rain.

Diffusion of liquids is that general property by which different fluids will mix with each other and may be called an adhesion of liquids to liquids. This of course varies also greatly with different liquids. So oil and water show very little adhesion to each other, while water and alcohol can be mixed in all proportions. Gases show diffusive qualities in a high degree and if different vapors are allowed in the same space the mixture is quickly and thoroughly accomplished. This is a very important and necessary quality and it is due the maintenance of pure air on the surface of the earth; for if gases had not this property, the heavier gases would gather on the surface of the earth and every living creature would soon be poisoned by the noxious products of combustion and decay. As it is they are speedily diluted as fast as formed and the diffusion is so perfect that the component parts of the air are practically the same everywhere.

MECHANICS.

We have shown in a former chapter that a body cannot change from the state of rest to that of motion of its own accord but that such change can only take place by the action of some force upon such body. It is the purpose of mechanics to find out the laws and conditions governing the effects of forces acting upon bodies; the effect of a force or forces acting upon a body may either produce motion or equilibrum (rest). That part of mechanics treating upon equilibrum is called STATICS, and that part relating to motion is called DYNAMICS.

Since mechanics must consider all kinds of bodies it has been found convenient to subdivide the science into three divisions, namely:

1 The mechanics of solids simply called STATICS and DYNAMICS.

2 The mechanics of fluids called HYDROSTATICS and HYDRODYNAMICS.

3 The mechanics of gases called PNEUMATICS and AERODYNAMICS.

All forces which come under our observation may be reduced to gravity, elasticity and muscular strength. A force may act just for one moment in which case it is called an IMPULSIVE force or it may act continuously in which case it is called a CONTINUOUS force. If an impulsive force acts alone upon a body it must produce uniform motion.

It took 60,000 cars to transport the grapes of the United States to market last year. The vineyards of this country represent an investment of $155,000,000 and over.

The American Engineer.

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CONTENTS OF THIS NUMBER.

SMOKE is a nuisance, according to the common notions. It may have advantages which we do not think of, and sanitary and other blessings may be hidden under its shadows; but whatever the advantages, it has very serious disadvantages, and a tempest of public sentiment is rising up against it. Chicago is to be the chief battle ground against smoke producers. In this issue we give an abstract of the views of the Engineers' Club of Philadelphia on the subject, and they consider that Chicago should take the lead in putting down the smoke nuisance as they have done in subduing professional anarchy. On the other hand, the mayor of Chicago and the city officials who have jurisdiction over smoke, are already taking determined steps to get rid of smoke as effectually as the heads of another department are destroying the English sparrows. The only public nuisance that Chicago is inclined to tolerate is the odor of onions and the fumes of the famous Chicago river.

CRANKS have developed into dangerous maniacs in numerous cases recently. A bill broker of Boston set the ball rolling, and the bomb exploding, by threatening to put a period to the life of Russell Sage, at New York, if he didn't get $1,200,000 on the spot. And being refused he suited the action to the threat, only that he killed himself instead of the famous millionaire. The incident has inspired many other cranks to threaten "heroic" deeds; and the steps of cranks are being scrutinized more closely than usual.

LIGHT colors are a protection against heat, as is well known, but it is a question if the color of paint is of such importance as implied in an article from one of our exchanges on the "Heating of ships and their cargoes," reproduced in this issue. To be white is to be destitute of all proper colors. And in white all the rays of the spectrum combined are reflected to the eye. How far that characteristic of "no color," as white may be called, affects heat we do not pretend to know. But the subject deserves close investigation. And it may be that light colors, as well as white, have a tendency to retard the dissipation of the rays of heating to a considerable extent.

THE TRANS-ATLANTIC EXPLOSION.

In continuation of our report of the explosion of a boiler on board of a ship at Falmouth, Eng., some remarks made by the Commissioners before whom the investigation was conducted are interesting. The president said: The adoption of two safety valves was a good practice, and they could not recommend it too strongly. The Commissioner then touched on the introduction of the washers and the screwing down of the spring balance of the lever safety valve, which was an improper thing to do. With regard to the incorrectness of the pressure gauge, the Court accepted the statements of Angel and Williams, and considered that the gauge for practical purposes was useless.

The explosion, the Commissioner said, was due to over-pressure, and the Court was of opinion that the boiler was subject at the time to a pressure very considerably exceeding the pressure of 70 lb. guaranteed by the Manchester Steam Users' Association. From an examination of the fragments of the boiler which remained, and from the evidence given during the progress of the inquiry, the Court was clear that there was no material deterioration of the plates from their original thickness of $\frac{3}{8}$ in. There was no indication of overheating, either from shortness of water or from the presence of salt in the boiler.

The Court came to the conclusion that Mr. Rusden was to blame for the explosion, as it was his duty, at all events in the absence of Mr. Anderson, to look after the boiler from time to time. He did not, however, look after it properly, or he would have seen that a new pressure gauge was badly needed, and that the safety valve was not acting properly. It was all important that he should have ascertained beyond all doubt that the remaining safety valve was in good order, because he knew that the lock-up valve which had been applied as an extra precaution had been removed. Rusden had displayed great recklessness in the management of this boiler, and he was to blame for the explosion. The Court held Mr. Anderson technically responsible for the defaults of his servants and fined him 70*l*.

The jury's verdict was, "died from injuries received by the unaccountable explosion of the boiler."

AMERICANS MUST BEAT THIS.

According to one of last Saturday's cablegrams, an engineering feat was completed at Stratford, England, the day before, which is calculated to make the ordinary man open his eyes in wonder. The Stratford works of the Great Eastern railway has broken the record for construction of a railroad engine and tender by turning out one complete in a single working day of ten hours. Up to this time the Crewe works has held the banner for speed in engine-building, but Stratford wrested it from it, and it will be a long time before it can be regained. The previous Thursday morning, at 9 o'clock, work was begun on a six-wheeled coupled engine and tender weighing sixty-seven tons, fourteen hundred weight, and it was finished within the time specified and at 9:15 Friday morning it was pulled out of the erecting shops amid the cheers of the workmen. They were immensely pleased, as may be imagined, when complimented on the feat, and in receiving the praise due to their efforts they implied a compliment to the United States for its speed in engineering matters by saying: "This beats the Americans anyhow; they havn't made such time yet."

CIVILIZATION, HOW DETERMINED.

A famous chemist once remarked: "You can determine the civilization of a nation by the quantity of soap they use." This is received by many as a pretty fair test. Investigation shows that the nations who use soaps, who regard cleanings necessary to decent living, are a long way from barbarism. But the enterprise of soap makers, with the demands of trade or commerce for new markets, has sent soap to every clime and land where enterprise and greed can place a salesman. Hence there are but few nations on this planet who have not learned the value of soap as a detergent, also the comfort and dignity of an occasional bath.

A correspondent of a technical journal concludes "that the civilization of a people might be fairly judged by the refinement of their methods in the use of artificial illuminants." That this is a logical conclusion is doubtful, from the fact that the races located near the north pole learned early to use a cup of whale oil with a fibre wick to enable them to do work in the long night preparatory to the long day which would occupy half the year. The leap from the pine torch to gas and electricity was not made solely through civilization, they were the results of the same experience and investigation that caused the savage of the stone-age to make the arrow head, axe and war club of stone. The difference between the experience and investigation of the stone-age and the present is one of degree rather than kind.

Another mechanical engineer suggests that "we can safely estimate the business activity (or civilization) of a nation by the measure of its transportation facilities."

When the Fathers of the Republic sent out the Declaration of Independence, it was a week before the news reached Boston, and notice of that meeting was signed months before the day of assembly to enable the immortal Fifty Six to be present from the thirteen states on the Atlantic coast. To-day they could be convened in thirty-six hours, by telegram and rail, but the ability of this generation to do in a few hours that which required months for the Fathers to accomplish, does not warrant the conclusion that our civilization excels theirs.

It is a fact that stands out prominently in the history of the world, that no body of men ever showed so high a degree of civilization as the noble men who invented and established a representative form of government for the United States of America. They were unselfish, humane and courageous, hence they evinced a wisdom that has never been equalled by the law makers that preceded them, they labored for humanity only, inspired by the feeling of universal brotherhood as taught by the Master, they made it possible for the lowest by investigation and experiment to become the highest.

The civilization of a people cannot be measured by the accidental discoveries of a few, or by the genius of others; nor can it be determined by its success in commerce, wealth or lavish expenditures, nor by its resort to labor-saving devices which increase production and cheapen cost, or by its vast enterprises which astonish more than they benefit humanity.

A nation that is civilized has been reclaimed from barbarism. Now if after all our triumphs in science, art, mechanics, chemistry, politics, theology, electricity, and transportation; if we furnish constant employment for thousands of policemen, hundreds of criminal courts and a thousand penitentiaries, can we claim to be fully civilized? True we use thousands of tons of soap weekly, we turn night into day with artificial light, we have lessened the time and cost of transportation, also send our messages to all parts of the world in a few minutes, but with all this discovery, with unlimited resources, are we less savage than the red men whom we have displaced?

The nation that regards the equal rights of all its citizens and deals justly with them acts in all cases in strict conformity to the Golden Rule, can be classed as a civilized nation. The nation that cannot exist without granting to certain families privileges not enjoyed by all is not a civilized nation, hence the only standard by which civilization can be measured is that which gives to all men in a state the rights which belong to humanity, under the rule that we render to others all that we expect from them.

THE DOCTOR.

INJURED AT AN INITIATION.

John C. Garver, of Rockford, Ill., a prominent member of the bar, has been laid up for over two months. It has just become known that he was injured while undergoing the initiation ceremony of a secret society known as the "Knights of the Globe." The injury is a serious one, it being supposed that a blood vessel is broken in one of his limbs. It is also supposed that the injury was caused by a severe blow or fall, and he may never fully recover the use of his limb.

STREET RAILWAY MOTORS.

Up to the middle of September there were more than 11,000 miles of street railway in the United States and Canada, of which 5,443 were for animal power, 3,000 electric, 660 cable, 1,918 steam. Street railway men think electricity must displace animals everywhere. In Pittsburg it is found that the operating expenses are 2.74 cents per car per mile greater for electric than for horse cars, but this is a necessary consequence of rapid transit. Allowing for this, a difference of 1.04 cents a mile for each car is figured in favor of electricity as against horses. In Boston there is a difference of 5 cents a mile for each car in favor of electricity. Including all the expenses and the interest on the cost of the plant, the cost for each passenger carried amounts, on the Boston electric roads, to 4.53 cents and on the horse roads to 4.98 cents.

THE HOLMES LUBRICANT BEARING.

The Franklin Institute has awarded the Elliott Cresson medal to Phillip H. Holmes, of Gardiner, Me., for his "improved lubricant bearing."

This invention furnishes a new composition for machinery journal bearings, which has the hardness required to endure wear and pressure, and to give surface that, without oil, will reduce friction to a minimum, and prevent the possibility of heating. This bearing has for its principal element, graphite, or "black lead," finely pulverized, and as far as possible freed from all gritty matter.

To hold the graphite, it is mixed with wet wood pulp, in proportions to suit the purpose of the finished article. When it is thoroughly mixed, it is placed in moulds to give it a desired form, care being taken to permit the water to escape.

The wood fibre strains the material and retains the fine graphite. After the composition has received the necessary pressure in the mould, it is thoroughly dried, then it is immersed in hot drying oil until fully saturated, when it is baked in an oven until it is hardened.

When finished, the bearing is solid and strong, and when supported by metal boxes, will endure heavy pressure, and it is a safe anti-friction bearing, with or without oil for any use. This bearing has been subjected to a variety of severe tests for the past two years, and ample testimony is given of its complete success.

We can think of many places where this bearing will reduce the cost, annoyance and danger of heavy bearings at high speed. For "steps" to upright heavy shafts, dynamos and turbine water wheels it must prove a positive advantage.

An interesting method of preventing a building from catching fire when adjacent buildings are burning has been adopted in the offices of a Glasgow (Scotland) paper. There is already in the building an efficient installation of automatic sprinklers for extinguishing what may come from within; but it is considered that there is just as much danger, if not more, from fires originating elsewhere. A supply pipe is therefore taken from the water tower which feeds the sprinklers and connected with a system of perforated malleable iron pipes which are carried along the ridge of the roof, the eaves and all over the windows. The pipes are usually kept absolutely dry, and to prevent their rusting they are coated with zinc. A pump is provided for forcing the water through the system of pipes and it can be brought into action almost instantaneously. The exterior of the building receives such a constant flooding when the pump is in action that there is absolutely no danger from an adjacent fire.

OUR FRIENDS.

VII.—IRA A. HOLLY.

We present in this issue a likeness of an engineer not unknown in his profession, one who has made no failures, in either of the responsible positions of trust, that he has filled. Mr. Ira C. Holly was born at Seneca Falls, N. Y., in 1843. His father, Alonson P. Holly, was at that time superintendent of Downs & Gould's Pump Works, which now does business under the name of the Gould Manufacturing Company. Mr. A. P. Holly afterwards formed a partnership with his brother B. Holly, and they organized the Holly Manufacturing Company, whose system of water works is known in all the states of the Union.

While young I. A. Holly attended the public schools, spending his vacations acquiring a knowledge of the tools that were used in his father's shops. When 18 years old, he graduated from the High School, with honor, and at once decided to perfect his knowledge of mechanics, he received for tutor a skilled mechanical draftsman, and for three years, with apprentice work in the machine shop, he was prepared for taking his place in his father's works as a skilled mechanic and draftsman.

When the War of the Rebellion came on, the government, requiring a competent superintendent for its Supply Machine Shops, Mr. Holly was placed in charge, his recommendations causing his selection over numerous competitors. He remained in

IRA A. HOLLY.

charge until the close of the war, when he returned to Lockport, N. Y., where he was employed as foreman of the machine shop named after that city.

He at length decided to "Go West" and journeyed towards San Francisco. On arriving at Burlington, Ia., he was so much pleased, that he decided to remain there, and accepted a position as foreman of a machine shop, where he remained until 1875, having, in that time, been appointed engineer of a fire engine, and subsequently Chief Engineer of the City Fire Department. Here he remained until called to Evanston, Ill., to take charge as General Superintendent of the water works system, and serving until 1879. The Holly Manufacturing Company, requiring his services, offered him a position as Superintendent of their Water Works system, which had been erected at Burlington, Ia., which he accepted, and was soon installed among the friends he had made there during his former residence in that city. He remained in this position until 1882, when he resigned to take charge of the "Erecting Gang," for the Holly Water Works System; this occupied him until 1884, when the American District Steam Company, appreciating the skill and experience of Mr. Holly, made him the Superintendent of Erection and Construction for their several plants, with whom he remained until 1889.

In 1889 he was induced to accept a position with the Syracuse Heat and Power Company, and having taken charge, May 1st, 1889, the ground was broken for the first pipe, and under the skilful arrangement of Mr. Holly, they have a Steam Supply plant, that is not excelled by any in this country. His employers claim that they have a skilled mechanic, a first-class engineer and a well bred gentleman; more cannot be said of any employee.

Mr. Holly carries around 207 lb. of humanity, saturated with jolly good feeling, for his fellow humans, affable, courteous, genial and every way a pleasant man to know and respect. His subordinates unite in testifying to his uniform good temper, and strict attention to his business.

Although 50 years have passed, since he began life, we predict for him many years of usefulness, and the success that all who know him, wish him to enjoy for many years.

QUESTIONS AND ANSWERS.

An "Amateur Electrician," of Salem, Oregon, asks:—

1. What are the standards from which the volt and ampere are reckoned?

A volt is so much electro-motive force as produces a current of one ampere in a circuit having a resistance of one ohm; it is the standard unit of electro-motive force, and is about one-tenth less than the electro-motive force of a Daniell's sulphate of copper cell.

An ampere is the standard unit of electric current, and is the current produced by one volt in a circuit having a resistance of one ohm. It was formerly called a current of one Weber per second.

"A Subscriber," Philadelphia, wants to know—

1. How to start up a Corliss engine—is it necessary to give it a back and forth motion?

It is not necessary to run the engine backward and forward.

2. What effect has the length of lead on the expansion?

The longer the time occupied by the lead the shorter is the period of expansion, inasmuch as so much less time is allowed for the eccentric to travel before it allows the cut-off to act.

"J. T. S." enquires:—What is an imponderable body?

Nystrom says: The term imponderable implies that the body has no weight, but is nevertheless, a material substance which is in such condition as to connection of attraction or regulation between ponderable bodies. All matter can be resolved into four aggregate forms—namely, *solid*, *liquid*, *gaseous* and *imponderable*; but there is no sharp line of distinction between these four forms—that is, a body may be in a semi-fluid state, like glaciers, which flow in a solid state; and many soft substances are neither solid nor liquid, but may be called plastic.

SOCIETY IN BIG CITIES.

The social life in our large cities is one of the most fascinating studies in the world. The women who comprise it are naturally the most beautiful and the most brilliant of their sex. Never have we, however, seen this whirl of society through the eyes of those who are its leaders. We have seen it from the outside, as it were, but now we are to have glimpses of it from the inside. During 1892, *The Ladies' Home Journal* will give its readers these glimpses in a series of interesting articles under the title "Social Life at Six Centres." Mrs. Burton Harrison, the author of "The Anglomaniacs" is to write of "Social Life in New York," and none can speak of it with so much authority as she who is one of its social leaders. Mrs. Admiral Dahlgren will portray "Washington Society," and Mrs. Annie de Koven, daughter of Senator Farwell, will write of "Social Life in Chicago." Then Boston, Philadelphia and San Francisco will follow. These articles will tell exactly what social life in a great city means, how dinners are arranged and given; how the women dress and act; the etiquette of the best parlors; what the daily life of a society woman means; how girls are introduced into the social swim and make their debut, and the other hundred and one things which are most interesting to read and know about in social life and warfare.

"BOY WANTED."

[Specially written for the American Engineer.]

One twenty-fourth day of December, Mr. Oscar Blont, who kept a large hat store at the lower end of Broadway, was writing at his desk which was at the very end of the room when someone touched his elbow softly, and looking up, he was much surprised to see a ragged boy who's broad brimmed hat nearly hid his face from view standing beside him; he was so much surprised in fact, that he dropped his pen upon his paper, thereby making a blot instead of a period.

"Well, my boy, how came you here?" he asked.

"I slid past some of the fellers. What a whoppin big store this is, and what lots of fellers it takes to stan' around. And I cheat some of them, and I told the rest I had something most awful particular to say to the big boss," talked on the little fellow.

"Well, what have you so most awful particular to say to me?" said the big boss in a much kindlier tone than that in which he had first spoken, for there was something in the boy's dark gray eye that reminded him of a darling son he had buried in the same grave he had buried his wife, and that was but a year before.

"Well, I seen a sign in your window what reads *boy wanted*, and I'm a boy. Nobody ever wanted me before, and says I to myself, says I, go in Dusty, old fellow, guess there's your chance at last, so in I comes.'

"Sorry, but you won't suit at all," says the big boss.

"How do you know 'fore you try a feller, I know I ain't very pretty, and I ain't got no fashionable clothes, but I's smart, I is. I been to night school two winters, I have got a six ward of merit, and I can read readin when its two syllabubbles, and I can spell it out when its three syllabubbles, and I can speak a whole lot of four syllabubbles, and I can whistle you or any other man in this big hat box clean out of his boots, and he commenced a lively tune, so loudly, clearly and sweetly that every one in the establishment turned toward the desk and listened.

"Yes, yes, I see you whistle remarkably well, but we don't want a boy to whistle," said Mr. Blont.

"I can dance too, I can. I danced at Johnnie Smith's benefit one day last winter when he fell through one of them coal holes in the side walk and broke his leg clean off short. I danced that night, I did, midst thunders of appause," and with that he broke into a rollicing break-down. His big shoes whobbled about, and the broad brim of his hat flapped up and down with every step.

"We don't want a boy to dance," said Mr. Blont, "here's a quarter for you, now run away."

"I don't want the quarter, I don't want to run away, persisted the boy. I didn't come clear from Fish-head alley down to this swell street to go away so soon, I want a sit-u-a-tion, four syllabubbles, and I ain't told you one-half I can do. I can see a *cop* fudder any our gang, and when one comes in the front door after you I'll give you the wink and out the back door you skip, hey? And I can speak pieces too, I can. 'A hoss, a hoss, my kingdom for a hoss; there's sixty Richmonds in the field to-day, I killed 'em every one, a hoss.'"

"Silence," roared the merchant, and then in spite of himself he broke into a fit of laughter, and shook his sides again and again, and there was a great deal of him to shake, 200 pounds at the very least, then he said, "well tell me about yourself. What's your name, and where do you live to begin with."

"Dusty is my name, ain't got no other. One feller, he's a country, he is, he calls me Dusty Miller, cause he says there's a flower there that they call that, but I guess he's a foolin; but if I'm the boy what's wanted I must get a nobbier name than that. What's your name, boss?" he asked, innocently.

"Mr. Oscar Blont," replied the merchant.

"*Mr, Horse Car Blont*," replied the boy. "Sounds very nice, you might call me that and you keep the Mister, or you might call me *Cable Car Blont*, any way you want it, 'you pay your money and take your choice,' and I live around anywhere since aunt Kate died."

"Aunt Kate," said Mr. Blont, "and is she your only relation. have you no father or mother?"

"No," said Dusty, "never had none 'cept Aunt Kate, and no friends 'cept Straw-hat, he keeps a paper stand around the corner. He gave a party one day last winter in a charcoal box. I was there, 'twas bully fun, you bet. I got a little brother."

"A little brother," said Mr. Blont.

"Yep, he was my cousin once 'fore Aunt Kate died. He's my brother now, and he just gobbles up bread and milk, and that's why I'm looking for a sit-u-a-tion (four syllabubbles) and Straw-hat he says to me, if you want me to say your honest and sober and dustrious I'll say it, say anything. He's a bully fellow, you bet, and I ain't givin' you taffy neither. He's taken care of me and my little brother since Aunt Kate died, but he can't do it for ever and ever and ever."

"Where is your little brother now?" asked Mr. Blont.

"Sitting on your stoop, waitin' till I come out," replied the boy.

"Sitting on my steps, why the poor little fellow must be half frozen, go and bring him in," commanded the merchant.

The boy flew and in a moment returned leading by the hand a wee child whose very small nose was blue with cold, wrapped in an old shawl, the ends of which dragged behind him.

"Now he's a boy," said Dusty, "and he's real nice and if he's the kind of a boy you want you can have him, but you got to be good to him and let me come and see him—say boss—to-morrow's Christmas," said the boy looking at the decorations in the store.

"Well what then," asked Mr. Blont.

"That's the day when folks get presents and boys what's got stockin's hangs 'em up, spossin', boss, just for fun, you let me and my brother be your Christmas present."

"*Done*," said the merchant, conquered at last by the boy's constant and persistent coaxing. I'll pretend I found one in each stocking, but mind, you must be the very best of boys and stop using slang or I won't have you."

"You bet your bottom dollar, I'll do anything you want me to. Hurrah, ain't this the bully racket. I'm the boy what's wanted in this establishment, (four syllabubbles) and I mean to be invaluable, (five syllabubbles). Crackey, I'm as full of big words as a booktionary, here you mind my little brother while I run and tell Straw-hat." And before Mr. Blont could reply he was out and away, and when he returned with his friend Straw-hat, he found his little brother sitting on the lap of the good-natured Colorado woman who keeps the store clean, as happy as any baby could be who had just eaten four sugar cakes and a stick of candy.

And Dusty Cable Car Blont proved himself to be what he himself said he would be, the very best of boys, and the very boy wanted in that establishment.

NEW SYSTEM OF TRAIN LIGHTING.

A new application of the old idea of lighting a railway train by means of the energy derived from the axle of a car or locomotive promises to lead to one of the most practicable systems of electric train lighting yet brought before the public. The new machine for the generation of current for lighting is a cylindrical dynamo, which is attached to the forward axle of the locomotive. The whole machine does not weigh more than 300 pounds and it is completely incased in an iron jacket, so that snow, rain or dust will have no effect on it. It is supposed to run for several weeks without any attention except oiling. An exceltent feature of the new system is that the lights retain their full power when the cars are at a standstill. The trouble in lighting by storage battery heretofore has been the great weight of the batteries and the cost of charging. Both these difficulties have now been overcome to a considerable extent. In each car a small but powerful storage battery will be placed. When the car is in motion these batteries become charged. With the stoppage of the train the current from the dynamo ceases, but the storage batteries instantly come into play and light the train. In case of a car being shunted on a side track from any cause whatever the lights remain in service for six hours with the normal battery power. This power can, however, be supplemented at any moment as desired. It is stated that within six months this system will be established on one of the most important railroads in this country.

SPECIAL BUSINESS NEWS.

(*From B. S. Castell, R. E. & F. E., Portland, Ore.*)

Following is a list of the plants now being installed in Oregon and Washington:—

Russell & Co. have just closed contracts for the following plants: One 13″x20″ 100 h.p. Russell single valve automatic engine and Corliss attachments for the Marshfield, Ore., Electric Light Co.; the Thomson-Houston Co. will furnish the dynamos which will be for arc lights.

One 10″x16″ Russell Auto. engine, and steam plant complete, for Oakesdale, Wash'tn, electric light plant; the Edison Co. to furnish dynamos for Arc lights.

One 13″x20″ Russell S. V. Auto. engine and steam plant complete, for the Astoria, Ore., Ry. Co.; the Thomson-Houston Co. to furnish the dynamos.

One 11″x16″ Russell Auto. engine and steam plant complete, for the town of Waterville, Wash'tn, electric light plant. The Thomson-Houston people will put in dynamos for arc lights.

One 11″x18″ Russell Auto. engine and steam plant complete, for the Independence. Ore., Electric Light and Water Co.; the Edison Co. will furnish the dynamos for arc and incandescent lights.

J. M. Auther & Co. have contracted to furnish and erect the complete power plant for the East Side Ry. Co., to run their entire railway system in this city, (Portland, Ore.) The plant will consist of 366″x16′ Erie City 2-sheet steel tubular boilers, two 20″x44″ Hoffman & Billing's Corliss engines; power to be transmitted by ropes; the dynamos to be furnished by the Edison Co., to be of 500 volts and 300 amperes each.

H. P. Gregory & Co. have a contract to furnish and erect the complete steam plant for the city of Vancouver, Wash'tn., electric light station. The plant will consist of one 60″x16′ Atlas 2-sheet flange steel tubular boiler; one No. 3 Blake pump; two dynamos to be furnished by the Thomson-Houston & Co. for arc and incandescent lights.

(*From E. E. Miller, Cor. Engr., Canton, Ohio.*)

Jos. Weaver & Son, wholesale and retail lumber, lath and shingles, and manufacturers of doors, sash and blinds, Canton, O., have finished their new plant.

They have two 50″x16′ steel boilers and one automatic Buckeye 14 1-4x16 engine, Miller steam pump and Otis heater.

They feed the dust and shavings from the machines to the furnace by means of a Boston blower, and Allington & Curtis dust arrester, and furnace feeders, and heat their buildings with Huyett & Smith's hot blast system, using exhaust steam.

The drying kilns are of Andrews' make, one a six car kiln and one large box kiln.

The plant is excellently located, having switches from all the railroads entering the city, and is as convenient and complete as it can be planned for handling and manufacturing their product cheaply and at the same time making first-class work.

LUBRICATING OIL FOUND IN INDIANA

A communication from Winamac, Ind., dated December 12, says: The drillers on the Switchers oil-well, near Medaryville, struck lubricating oil at 9,000 feet, and the daily output is ninety barrels.

HOWLAND'S "PERFECT SCREW."

Prof. Howland, of John Hopkins University, has just finished his wonderful dividing engines, by which he rules tens of thousands of lines to the inch, he has perfected what is known as a "perfect screw."

With this screw, he is able to move his diamond-pointed ruling pen across the plate with wonderful accuracy as to uniform parallel lines of such fineness that the lines cannot be seen without a powerful microscope.

The plates or "spectrums" which he prepares with his engine are indispensible in the spectroscope, an instrument by which the colors of a light radiated from the sun or either of the heavenly bodies can be analyzed and the material that is burning or supplying the light determined.

BILL MASON'S BRIDE.

Half an hour till train time, sir,
And a fearfully dark night too,
Take a look at the switch light Tom,
Bring in some wood when your through.

On time, well yes, I guess so,
She left the last station all right,
She'll come around the curve a flying.
Bill Mason comes in tonight.

You know Bill? no? why he's the engineer,
Been on the road all his life,
Well I remember the evening,
He married his brave little wife.

Bill hadn't been married more than an hour,
When up comes a message from 'Cress
Ordering Bill to go up there,
And bring down the night express.

Bill left his wife in a hurry,
Went up on number one,
Thinking of nothing but Mary,
And the train he had to run.

And Mary she sat at the window,
To watch for the night express,
And, sir, if she hadn't done so,
She would have been a widow, I guess,

For somewhere near midnight,
These mill hands left the ridge,
And came down there, the drunkards,
And tore up the rails from the bridge.

But Mary, she heard, them aworking
And knew that something was wrong,
And less than fifteen minutes
Bill's train would be coming along.

She couldn't come here and tell us,
A mile it couldn't be done,
She just picked up the lantern,
And made for the track alone.

And down came the night express, sir!
Bill just amakin' her climb,
But Mary hung on to the lantern,
A swinging it all the time.

Well, sir, Bill saw the signal,
And stopped the night express,
And found his Mary acrying,
On the track in her wedding dress.

A crying and laughing for joy, sir!
And a holding on to the light,
Hello! here's the train, good-bye, sir,
Bill Mason's on time tonight.

LONDON CRYING FOR MORE LIGHT.

Electric lighting in London is making wonderful strides, and the only thing which now stands in the way of its universal adoption is expense. The cost of wiring a house for electric light for a reception averages 32 shillings, or about $9 a lamp, but some of the necessary appliances used for house-wiring are covered by patents which naturally increase the cost of a very great deal. Incandescent lamps are to be purchased for just $1 apiece, but in a couple of years, when the patents on it expire, it will be possible to get them for from a shilling to one shilling and sixpence each, or about a third of the present cost. It is also confidently expected that within that time it will be possible to do all the wiring at the rate of £1 a lamp, and it will not be many years, therefore, before gas will be superseded in the household except when used for fuel. The advantages for this will be sufficiently obvious, and then it is to be hoped that the civic authorities will institute the universal application of the electric light for the illumination of the streets of the city, and so remove the stigma of the greatest city in Europe being the worst lighted.

PLEASANT AND HEATHFUL.

If you want a lovely odor in your rooms break off branches of the Norway spruce, and arrange them in a large jug well filled with water. In a few days tender, pale-green branches feather out, soft and cool to the touch, and giving the delightful healthgiving odor.—*Scientific American.*

CORRESPONDENCE.

Graham Council, Ill.

Editor, American Engineer:

Please announce that Graham Council, No. 6, Fairbury, Ill., has suspended James Gouthrie for failure to pay his dues.

F. P. DAVIS, Chf. Engr.

Twelve Dollars a Week.

Editor, American Engineer:

The following advertisement recently appeared in a Chicago daily.

Engineer wanted.—One familiar with dynamo; German preferred; wages $12. Apply———.

Here is a steam user who offers a man that has a practical knowledge of steam and electricity the enormous sum of *twelve dollars* a week to take charge, and prevent his boiler from "blowing up," compel his engine to furnish regular and sufficient power, and see that his dynamo supplies the light that will enable the liberal (?) employer to add other thousands to those that his generous (?) business methods have enabled him to accumulate.

Let us examine this singular advertisement and see what this advertiser expects to get for "twelve dollars a week." He wants a man that understands the laws governing the combustion of fuels. and how to avoid the police court by the "Smoke Preventing Ordinance Route." This involves considerable knowledge whether gained in schools, from books, or a long apprenticeship under competent instructors, a knowledge of combustion to insure economy in the use of fuel and a knowledge of the chemical composition of the fuel that will enable him to prevent black smoke by effecting as near as possible perfect combustion, thus burning all the carbon sulphur, also the sulphurated hydrogen, carbonated hydrogen, and carbonic oxide gases, permitting the carbonic acid gas to escape up the stack, all this is necessaay to keep the "Smoke Inspector" from pouncing on the liberal proprietor, on failing that, to drag the unfortunate twelve dollar practical scientist before some hard hearted magistrate to be fined a reasonable sum, which the liberal proprietor may pay for him, then deduct it from his wages.

In addition to this the twelve dollars must purchase a fair knowledge of steam and its vagaries, a knowledge of boilers, their construction, their strength, capacity and be very sure that this particular boiler is fully competent to safely carry the pressure for which the safety-valve is loaded.

The twelve dollars a week must procure that knowledge of the engine and machinery that will prevent recourse to the "shop" if the eccentric slips, the "twelve dollar" man must be able to put her on the center, and adjust the valve to secure the same amount of steam front and back of the piston and fasten the eccentric securely in the proper place, even if there be no center punches placed there by the builder of the engine. He must see that the boiler is not covered with scale inside, composed of sillicated sulphate of lime, which the waters of Lake Michigan generously supply, hence on Sundays he inspects his boiler, and if necessary crawls into the man-hole and carefully examines the rivets, sheets and stays; finding all secure he removes the scale and sediment, and after washing the boiler clean, closes and fills it with water for the next week's run.

Then he goes to the engine and any defect or derangement is remedied, when having finished his seven day's hard toil for twelve dollars, he wonders if he can induce the proprietor to pay him double time for this extra work. As he starts to doff his jumper and overalls, he remembers that he had a "ground" last week that compelled him to walk on boards when near the dynamo. He thinks he would like to be at home with the wife and children, but he must earn that twelve dollars, and he tackles the electrical department, and when he has finished he looks at his watch and learns that it is 8 p. m. The day is gone, the children have gone to bed, and tired, hungry, worn out, the "twelve dollars a week" goes to his home to rest—to sleep, knowing that he has to rise early to start the engine in time for the day's work.

Then again there are pumps to keep in repair and at work, perhaps an elevator that requires attention, and if there are machines operated, the belts, bearings and gears when going wrong, must be made right by this wonderful man who is paid twelve dollars a week.

Here we have a fine opportunity to measure the liberality of this generous advertiser; he inserts in a daily paper his advertisement, in which he calls for a man to insure his plant against delay or loss of time, to secure himself and employers from being blown to pieces, or nicely parboiled by scalding water, to prevent his property from being destroyed by a boiler explosion, to secure economy in fuel, lubricants and repairs; and all this for the pitiful sum of "twelve dollars a week" with no mention of extra pay for overtime.

We dismiss the subject with the hope that the time will soon come when the engineer will be paid all that he can earn, when justice and not greed will fix his pay, and if the work requires skill, experience and a knowledge of practical science, that we shall see no more advertisements calling for a man to practically exemplify his knowledge of a dozen branches of applied science for "twelve dollars a week."

THE DOCTOR.

HEATING OF SHIPS AND THEIR CARGOES.

At a recent meeting of the Shipmasters' Society, London, a paper was read by Captain A. G. Froud on "The heating of Ships and their Cargoes and the Waste of Heat in Steamers." He stated that, to some extent, the heat of ships, depended on the materials of which they were constructed, and was influenced by the color of these materials. It was also influenced very much by the condition of the cargo carried, and by interior and superficial arrangements largely under the control of those having charge. Some minerals, notably coal, animal matter, such as wool, also cotton, jute, flax, esparto coffee, sugar, copra, rice, seeds, and grains of all sorts, oil and cotton-seed, cake, &c., if not well dried, generated heat. A few kinds of manufactured goods, matches, oil cloths, &c., were dangerous as were chemicals. An official caution, dated August last, warned shipmasters against the sulphides of sodium and potassium. A recognized authority on Australian cargoes stated that, amongst other articles, copper and antimony ores were specially liable to sweat, and this circumstance should be borne in mind when stowing other goods above them. He advocated the free surface ventilation of coal and other cargoes, especially in dry weather, and always, excepting when signs of liability to burn were apparent. The course then was—shut up the holes closely, or act according to the special circumstances of the case. It was the captain's duty to check the shipment of damp cargoes of all kinds as far as possible. Ships should be painted either white, buff, or gray, passenger ship more particularly, and those carrying frozen meats and petroleum would reap great advantages. Vessels laden with cargoes given to heat and damage would also benefit largely. The boilers, cylinders, and all the parts of marine engines, where the maintenance of heat was essential as well as all the bulkheads about them, should be painted of the lightest colors; and he ventured to assert that railway companies would effect very considerable economies by using light colored paints for their locomotives.

DARKNESS OVERCOME.

Lighting is a very important question in latitudes where the sun does not shine at all for two months in the year, The most northerly town in Europe where such conditions exist is lighted by electric light down to the smallest house. Hammerfest has the good fortune to be in the neighborhood of a river which flows so rapidly that even in that region of intense cold it cannot freeze. Power is supplied from this river by turbines and the little colony has now no fears for its yearly spell of darkness. In the matter of light it has decidedly turned the tables on natural conditions and is distinctly the gainer, for there are seventy-one days in the summer during which the sun never sets.

Germany has 59,000 stationary engines and 10,000 locomotives.

MAIN STEAM PIPES.

The recrudescence of explosions of main steam pipes is a subject which has called forth very considerable attention at the hands of marine engineers, and it is certain that in new steamers, especially those belonging to well-known lines, the main steam pipes receive that careful supervision and examination which a dearly bought experience has shown to be necessary. We are used to associate explosions in main steam pipes with the use of high pressure steam, and at first sight it does appear to be bad engineering which uses practically the same specification for a pipe to carry 150lb. as for one intended to bear a pressure of 60lb. per square inch—that is, the same method of construction is used although the thickness of material and the diameter are altered. But explosions or ruptures of steam pipes carrying what are now comparatively low pressures are by no means unknown, although the outside public only hears of them when an inquiry is held under the Boiler Explosions Act. Such a case is that of the bursting of a main steam pipe on board the steamer *Rohilla* on July 16 last, the official report of which is dated August 3, and is only issued to the public some three months later—a striking instance of the necessity of inquiring into the delay which almost invariably attends the issue of important public reports. This, however, by the way.

The *Rohilla*, a fine steamer belonging to the P. and O. Company was about to leave her moorings at the Albert Dock, London, and proceed to the East, when the aftermost length of main steam pipe burst, with the result that three Lascars were scalded, one of whom eventually died. The *Rohilla* has a pair of compound engines, working at 80lb. per square inch, and steam is supplied by six "high" boilers. The main steam pipe is of copper, No. 4 B. W. G. thick in the straight and No. 3 B. W. G. in the bends. The internal diameter is 14in. The sheets composing the pipe were, after being bent to the proper radius, united at their edges by a single lap joint, the rivets being ½in. in diameter, and pitched about five diameters apart. The seam was internally covered over with solder or brazing. The flanges of the pipe were of brass, and were rivetted and brazed to the pipe. After completion the pipe was tested to 160lb., and we may be sure that, coming from such an eminent firm as Messrs. Caird, and for use in such a service as the P. and O., nothing was omitted to ensure the stability of the pipe under the generally-received conditions of working. We should say that, and, indeed, have on previous occasions urged that main steam pipes should be rivetted instead of brazed, and we are surprised to read in the report that since the *Rohilla* was built in 1880 Messrs. Caird have given up the use of rivetted steam pipes. At the same time brazed steam pipes, when treated by serving over with steel wire, as in Messrs. Laird's practice, or by slipping over steel rings, as done by Messrs. Denny, have so far given most excellent results, and many engineers regard these methods as a solution of the steam-pipe difficulty. What Messrs. Caird's present practice is we do not know. From the report we gather that the steam pipe of the *Rohilla* failed when the steam gauge showed but 68lb. From the excellent series of drawings annexed to the report we see that the arrangements for drainlng the pipe were somewhat defective. In fact, the main steam pipe could not be said to properly permit of the escape of condensed water without the aid of steam pressure, as the exhaust pipe from the auxiliary engine into which pipe the drain pipe led rises to a considerable height above the level of the bottom of the main steam pipe before it falls into the exhaust tank.

It is the opinion of the Board of Trade Inspector that there was an accumulation of water in the main steam pipe, and that this was set in rapid motion in consequence of the opening of the starting valve on the low-pressure cylinder. It should be stated that the pipe supplying this valve is led from the engine-room stop valve chest. If this opinion is correct, and we see no reason to question it, we have but another example of the danger which arises from an accumulation of water in a pipe. The main steam pipe had been in position ever since the vessel has been built, and had never before shown any signs of weakness. The engineer of the ship had been in her over two years, and the other a year and a half, and doubtless, as is the practise in the regular liners, they had a routine system of working the machinery. On the day of the explosion they seem to have taken all proper precautions, and to have in no way hurried anything. There was no sudden rush of steam into a comparatively cold engine, and no evidence is adduced that the owners or their servants had omitted to effect any necessary repairs at any time. A curious feature about this case is that after the explosion the cover of the engine-room stop-valve was found to be cracked, and on breaking up the cover the cracks were found to have existed for some time anterior to the explosion. This fact taken in conjunction with that that the internal surface of the main steam pipe was excoriated, shows that there must have been water passing over from the boilers, and that the pipe and stop-valve had been subjected at various times to severe shocks. It is, of course, well known that the presence of condensed water in pipes is a source of danger, but little is known of what exactly goes on in the pipe. We have the incompressible liquid, the expansive gas, or practically so, and the tube with a "dead head" Seeing that the tube or pipe is capable of withstanding all the presure that the steam can give, it is difficult to account for the tremendous repelling force, which is, undoubtedly, brought into operation. Of course there are many theories.—*Invention.*

HOW THE INJECTOR DOES IT.

The injector is a very handy little tool to have attached to a boiler, even though it may be an extravagant method of feeding. It has been proved beyond doubt that a belt-driven pump is the cheapest possible way of getting feed water into a steam boiler, only excepting, and perhaps not in all cases, the exhaust injector. How the injector does it is a question which paper-mill men have asked many times, and some of the best steam engineers cannot give the desired answer, says *Invention.* It is easy for a man to understand how a steam pump forces water into a steam boiler against a pressure as great as the steam which drives the pump.

The reason why the pump does its work is that the sectional area of the steam cylinder is greater than the sectional area of the water cylinder. And, therefore, with a pressure of the water piston of 800 lb., and a pressure of steam of 1,500 lb., acting against the same, it is easy to see that the water must yield and be forced into the boiler. This is precisely the way in which an injector works, but it is hard to explain how such action takes place. It is safe to say that the actual energy of any body is proportional to its weight multiplied by the square of its velocity.

Here is a clue to the action of the injector. Steam issuing from a boiler under a pressure of 60 lb. will have, if discharged into the atmosphere, a velocity of 1,700 ft. per second. When discharged through a pipe the steam encounters water in the combining chamber of the injector. Doubtless the velocity of the steam is considerably reduced before the water is reached, but as the steam is instantly condensed into a space 1,000 times as small in area of cross section as it was before condensation, it is easy to see that considerable velocity will remain, the small cross section of steam after it is condensed corresponding somewhat to the small area of the water cylinder of a pump. When the steam thus condensed unites with the body of water in the combining tube of the injector, much of the momentum of the column thus described in motion is imparted to the water in the combining tube, and the latter is forced into the boiler. It seems that the weight of the water to which steam imparts its velocity gives it a momentum which is greater in the small area in which its force is exerted than in the boiler pressure. Therefore, although its force has actually been derived from boiler pressure itself, the combining steam is able to force a certain quantity of water back into the boiler, under precisely the same law as when a pump is used.

To support this theory it is only necessary for the engineer to remember that certain injectors will not work well when the steam pressure is too high. In order to work at all the injector must condense from the steam which flows into the combining tube. Therefore, when the steam pressure is too high, and as a consequence the heat is very great, it is difficult to secure complete condensation; so that for high pressure of steam good results can only be obtained with cold water. It would be well when the feed water is too warm to permit the injector to work well to reduce the pressure, and consequently the temperature of the steam supplied to the injector, as low pressure steam condenses much easier, and consequently can be employed with better result. Throttling the steam supplied by means of stop valves will often answer well in this case. The steam should not be cold or it will not contain heat units enough to allow it to condense into a cross section small enough to be driven into the boiler. This is the reason why exhaust injectors fail to work when the exhaust steam is very cold. It also explains why such injectors work well when a little live steam is admitted into the exhaust sufficient to heat it above a temperature of 212 deg.

The lifting attachment is applied to any injector, is simply a steam jet pump. It is combined with the injector proper, and is operated by a portion of the steam admitted to the instrument.

JUST WHAT IS WANTED.

A machine often wanted is a small, cheap and efficient water motor for driving small dynamos for laboratory or trade purposes. Such a motor is now successfully used and consists of a simple arrangement of force-buckets propelled under high pressure, house or other water supply. Inside the case is a thin dram of considerable diameter, on the circumference of which are small double buckets. The water entering by the supply pipe impinges with orce on these buckets and drives the wheel with great rapidity and power. The water falls out of the exhaust and is run away or can be led into cisterns for other use. The mechanism of this useful machine is very simple and the motor will run for months without other attention than turning the water on or off and maintaining an occasional supply of oil. It makes no noise, starts easily, occupies little floor space of high officiency. It is likely to be largely used for telephone dynamos and for small electric-light installations up to fifty candle-power.

GETTING THERE.

An engineer, a blacksmith, or any other worker in iron metal who loves his calling, will always be finding something new in it. Now, that man can make a cast or wrought iron literary reputation if he will set himself to work and acquire facility of expression with the pen. He can do this if he tries and persists in trying, for there is little that the mind cannot overcome if it sets itself to the task of overcoming. He will never accomplish such a result, however, if he says he cannot, and th t it is "no use for him to try," at the start. Mention is made of a whaling captain, afterward in the revenue service, who made a study of whales, and who wrote, and illustrated as well, a book on whales, which is probably the most valuable work of the kind extant. Looking over his manuscript one day in his cabin, a friend was surprised at the ability the captain displayed in his drawings, not only of the whales, but appropriate marine subject accompanying them. The friend asked the captain where he had learned drawing: "I learned myself," said he, "I put my mind on it, and what I wanted of the art came by degrees."—*Inland Printer.*

THE WOMEN'S DEPARTMENT.

An Association of Women.

The Columbian Association of Housekeepers and Bureau of Information met in the new Church Temple on Van Buren street last Saturday evening, with 100 members present. The president announced that the association had lost one of its most devoted workers in the death of Mrs. E. A. Matthiessen, Chairman of Committee on Cooking Schools and Industrial Schools. During the short time since the association had been formed Mrs. Matthiessen has been most faithful in preparing the work of her committee.

The new committee appointed to take up the work of physical culture and correct dress was disbanded, as Mrs. Parker, Vice-Chairman of the Educational committee of the Woman's Auxiliary, already has planned for its work in the congresses.

Mrs. Ellis reported the work done by sewing schools Saturday mornings. The attendance at two of the schools she visited was very good and the work well planned. The only difficulty was the irregular supply of teachers. The few visits she made to dressmakers' establishments had not developed any further information than that the girls were not taught by system nor were they in any sense of the word apprentices.

Mrs. White, Chairman of the Food Supply committee, presented many hygienic suggestions in regard to the adulteration of food and advised housekeepers to avail themselves of those articles of prepared food which save time.

The majority of those present seemed to think that the word woman was a much more dignified termed than that of lady, owing to the frequent misuse of the term.

After several announcements the meeting adjourned until Wednesay, Jan. 14, 1892, at 10 a. m. in the New Church Temple.

The Family Mending.

Mending should be done just as regularly as washing. Set apart a day and do your work on that day; then it will not accumulate until it makes your heart sink to look at—the housewife's common experience. Have a basket, box or bag well stocked with the materials for the work. When a garment is cut, collect all the pieces, roll them together and put them where you can find them when wanted; thus you save the fatigue and annoyance of rummaging the whole house for them. The precaution of putting pieces under the thin places defers the final breaking through of the worn sections for some time. When they do at least come to rags cut out evenly all the worn parts, following a thread if you can when cutting; at the corners cut diagonally into the garment about one-eighth of an inch, turn in the edges and baste down on the patch. Then fell down with even stitches, using quite fine thread of a color that matches the goods. In mending two corresponding parts of a garment, like two sleeves, two knees, etc., have your patches of corresponding sizes. Don't have a patch on one elbow or knee no bigger than a dollar and on the other knee as large as your hand. I have always found it a very satisfactory plan in making garments to make three where most people make two or to make two where others make one. That is, instead of making a pair of shirts I make three, and instead of two pairs of drawers make three pairs, and instead of one waist to my work dresses I make two. Then when they come to mending, take the extra one for patches.—Dorothy Lincoln, in *Farm and Home.*

A Bright Coin makes Bright Eyes.

A simple and excellent plan to preserve and strenthen the eyes is this: Every morning pour some cold water into your washing bowl; at the bottom of the bowl place a silver coin or some other bright object; then put your face in the water with your eyes open and fixed upon the object in the bottom, move your head from side to side gently, and you will find that this morning bath will make your eyes brighter and stronger, and preserve them beyond the ordinarily allotted time.

Woman's Genius.

While those who decry women use as one of their chief arguments the statement that women have no inventive faculty, women, it seems, from the actual official returns, go straight on inventing says *Harper's Bazaar*, Not to speak of Catharine Greene, the wife of Gen. Nathaniel Greene, who undoubtedly invented the cotton gin, and whose second husband induced her to abate her fear of ridicule and claim an interest in it, or of Mrs. Walton's achievements with noise-deadening, with smoke-burning, and with similar experiments, there are many other inventions by women of equal importance. One woman has invented a method of converting a barrel of oil into ten thousand cubic feet of gas; another has invented a sewing machine that needs no threading; others have invented the ruffling and quilting attachments to such machines, and arrangements for sewing duck and leather. One such attachments made a fortune for Miss Helen Blanchford; and a new baby-carriage brought to its inventor, a woman,the sum of a hundred and fifty thousand dollars. Another woman has invented a superior street sweeper; another, a spinning-wheel carrying as many as forty threads; another, a plan for heating cars; another; a screw-crank, for steamships; and a chain elevator, a horse-shoe machine, a reaper and mower, a danger signal, and so on without end, owe their existence to the brains of women. It was Miss Knight who invented a complicated machine for making the square-bottomed paper bag, and refused fifty thousand dollars for the patent, and who also invented another machine that does the work of thirty pairs of hands in folding these bags. It is Mrs. Armstrong who has invented a machine for feeding cattle on trains; it is Josephine Davis who invented an arrangement of lamps and rubber cloth for a hot vapor bath at home; Mrs. Beastly, a machine for turning out complete barrels by the hundred; Anna Conolly, a practical fire-escape; Mrs. Bailey, an attachment to beds by means of which the patient can raise and lower himself. And among all these inventions none is perhaps of a more pleasing and grateful character than that of Mrs. Nancy Johnson, who invented the first ice-cream freezer but who, not so wise as some of her sisters, sold her patent for fifteen hundred dollars, all ice-creams previous to her crank having been made by a slow and laborious stirring.

And this is merely skimming over the surface and selecting a few instances that most easily strike the eye, leaving the multitude unmentioned. Nor are these inventions confined, it is evident, to the walks in life most familiar to women, as, among others, the grain-elevator, the screw-crank for steamships, and the barrel-maker testify. And while the existence of all these patents and their results ought to confound the careless speaker who thinks so lightly of feminine capability, it does something far more important in showing how greatly enriched the whole world will be when the feminine mind as well as the masculine is fully brought to the work.

A Girl is not Pretty

When she cannot look one honestly in the eye.

When she has an acquaintance with the rouge pot.

When she shows her bad humor and puts on frowns.

When she thinks to improve on nature and bleaches her hair.

When she does not keep her hands clean and forgets to care for her nails.

When she does not study the style of hairdressing suited to her and persists in wearing it in an unbecoming manner.—*Music and Drama.*

She kept her age a Secret.

Mrs. Pry—"I've been to Mrs. Slye's funeral and I must say that she was the most aggravating woman I ever knew."

Mrs. Quiz—"For mercy's sake, what has she done now?"

Mrs. Pry—"I don't know as you'll believe me, but, actually there was no age on her coffin plate. Isn't it disgraceful?"—*Boston Transcript.*

GRANDMA'S CHRISTMAS PUDDING.

Come everyone, and you shall hear
Why naught can equal, far or near,
In toothsome relish, savory cheer,
Dear Grandma's Christmas-pudding.

Here, word for word's the recipe,
Told from her dear, quaint lips to me,
Which closely followed—try! and see!
Makes Grandma's Christmas-pudding.

"Begin," she said, "some weeks before
The holidays, with generous store
Of *cheerfulness.* Add more and more,
To Grandma's Christmas-pudding.

"Now, pound for pound, the fruit you bring.
For currants—*Christmas-carols* sing.
For citron—*jingling sleigh-bells* ring.
Oh! joyous Christmas-pudding!

"Then come the plums—*love-laden gifts,*
While *Charity* the sugar sifts
Abroad with flour, in whitest drifts,
For Grandma's Christmas-pudding.

"Spice well 'to taste,' with *mirth* and *toasts,*
With *sliding, skating, snow* and *coasts,*
While every rollicking scion boasts
Of Grandma's Christmas-pudding.

"Then mix, in savory, pungent dough.
Stir in some sprigs of *Mistletoe,*
With *bubbling laughter* boil—'just so.'
Dear Grandma's Christmas-pudding.

"When served, with *holly* it is crowned.
The brandy—*joyous spirits* found
On happy faces, all around
This festive Christmas-pudding."

—*Hannah Sedgwick.*

HOME AND HEALTH.

If the head aches look well to the stomach.

A bedtime luncheon of lettuce induces sleep.

For faded green blinds, rub on a little linseed oil.

Nuts or apples eaten with plenty of salt are said to aid digestion.

The juice of a lemon rubbed over the kitchen table removes all grease.

Sleep obtained before midnight is of far greater value than sleep gained after that.

Sleep in a well-ventilated apartment where there is free circulation of fresh air, but not in a draught.

Suffocation from smoke may be avoided, without impeding the breath, by tying an unfolded wet silk handkerchief over the face.

The gilt on china is washed off by the use of soap; moderately hot water and quick washing and drying is recommended as a preservative.—*Scientific American.*

A Successful American Artist.

Mrs. Leslie Colton, the young American artist who is exhibiting in London and Paris, has won her reputation in the last two years. She exhibited at this year's Royal Academy a half-length oil portrait of Mr. Frederick Martin, brother of Mr. Bradley Martin, which was pronounced the best portrait in the collection, while the head in pastel of the Duke of Cambridge, done by Mrs. Colton, is said to have procured for her orders for portraits from eleven English notabilities.

She Believed in Cremation.

Cremation has always had very warm advocates, but, for an example of practicing what you preach, Miss Honoretta Pratt stands prominent. She died early in the eighteenth century, and in St. George's, Uxbridge road (now more fashionably called Bayswater, London), the following record is given: "This worthy woman, believing that the vapors arising from graves in church-yards of populous cities must prove hurtful to the inhabitants, and resolving to extend to future times, as far as she was able, that charity and benevolence which distinguished her through life, ordered that her body should be burnt, in hope that others would follow the example—a thing too hastily consured by those who did not inquire the motive." Peace to her ashes.

A Domestic Catastrophe.

She stood before the mirror, her hand so wee and white
Pressed on her locks that rivaled the darkness of the night;
Her face grew pale and ghostly in a whirl of wild surprise,
Ane floods of tears came bubbling from the fountain of her eyes.

Her lissome frame went rocking in agonies of grief,
The smelling salts she used to take could not give her relief;
And while her bosom heaved in pain to each heart-rending throe
Shc looked a picture of despair—forlorn in her great woe!

He rushed to where his darling wife stood writhing to and fro,
And asked her what was up that she should sob and blubber so?
He took her in his arms and there, just as a husband may,
He tried to calm her foolish fears and kiss her tears away.

"Oh, woe is me! Oh, woe is me!" the hapless creature cried,
With groans that shook the frescoed roof and echoed far and widc!
He grasped her tap'ring fingers and opened them, and there
He saw the first gray thread that she had winnowed from her hair!

—Eugene Davis, in *Chicago Mail.*

A Dainty Way to Furnish a Bedroom.

There is no prettier, fresher, or daintier way of furnishing a bedroom than to have the walls hung with the same chintz as the covering for the furniture and the curtains. With a little brass bedstead trimmed with a flounce of the same chintz, a pink, blue, or white enameled dressing table and washstand, a couple of easy chairs and a lounge covered with the pretty cretonne, and a few other accessories, such as a tea-table, book-shelf, a few favorite photos and pictures and pretty rugs, you have a bedroom fit for a princess. There are some charming patterns shown this season in these lovely chintzes. Every color is represented. Tufts of yellow, primroses on the lightest of silver-gray grounds, garlands of wild roses on pale turquois blue, bunches of forget-me-nots on a sort of yellowish cream-color, and natural-looking wood violets sprinkled over a background of a lighter shade of lilac—one and all they are lovely, and so are most difficult to choose from.

No Woman on the Board For Him.

One of the first women to be appointed to public office in the South was Miss Laura Towne, who had spent many years in teaching the negroes on the Island of St. Helena and was appointed as a member of the Educational Board. The colored man who was President of this Board indignantly exclaimed; "A woman on de Board? No! I don't sit on dis board with no woman?" and after she had, with difficulty, shown him how to swear her in he said: "Now I'se swore you in I going to swear myself out." It is claimed by Southern women now that there are more men in South Carolina willing to grant the suffrage to women than there are women willing ta receive it.

Girls in Alaska.

An Alaska girl is ready for society as soon as she enters her teens. It does not require many years in that country for a girl to grow up. The dress of the average Stickeen maiden is not very elaborate. A plain cotton garment, long and loose, envelops her person, and her Turkish bath towel is wound about her head. When she goes out, a blanket of bright colors is thrown around her shoulders. The wife of a missionary in that section says the young women often go bare-footed, but that after they see the shoes of the white women their greatest desire is to have a pair.

LITERARY NOTES.

The Lidgerwood Manufacturing Co., 96 Liberty street, New York, have issued an illustrated pamphlet on "Phosphate Mining," containing sketches of the hoisting and conveying devices employed in that business. The Lidgerwood improved suspension cableways are fully illustrated, as far as they are applied to phosphate mines. Their cableways for these mines are smaller than the regular Lidgerwood cableways which have been in use for several years, and gained a high reputation. In principle and construction the new size is the same.

Cassier's Magazine for December (vol. 1, No. 2), contains descriptions, profusely illustrated, of the laboratories of Sibley College, Cornell University, being apparently the first of a scries of chapters on the Technical Schools of America. This one is by Prof. R. C. Carpenter. *Cassier's* is a brand new magazine. But it is first-class, and those interested in illustrated engineering topics cannot fail to he delighted with it. It enjoys already the substantial backing of 76 pages of advertisements. The present number contains an article on "The Stationary Engineer," by L. A. Blake, of Ann Arbor, Mich., to whom a prize of $10 has been awarded, also an article by J. W. Power, of West Bay City, Mich., on "Feeding water to the boiler," to whom a second prize of $5 has been awarded. Similar prizes are to be paid monthly for articles by working engineers. The office of publication is at the Potter Building, New York City.

BUSINESS NEWS.

Wm. Sooy Haythorn & Co., of 94 Franklin street, Chicago, of whose automatic return valve an illustrated description was published in our last issue, are large contractors for steam heating and ventilating apparatus, as well as manufacturers of Haythorn's patent strainer and return valve. They are also dealers in steam engines, hoilers and pumps, and they have a good reputatien for reliability, promptness and moderation in prices.

Map of the United States.

A large, handsome map of the United States, mounted and suitable for office or home use, is issued by the Burlington route. Copies will he mailed to any address on receipt of 12 cents in postage by P. S. Eustis, Gen'l Pass. Agent, C., B. & Q. R. R., Chicago, Ill.

FIRST-CLASS MACHINIST WANTED.

WANTED.—No. 1 Machinist with good education, practical, progressive and pushing; willing to receive orders; work for Company's interest. Living cheap, climate good. State wages and experience and give reference.

Address "LATHE," care of the American Engineer, Pontiac Building, Chicago.

RESPONSIBLE POSITION WANTED.

Mechanical Engineer, competent to design, construct, estimate cost, supervise erection, etc., of general machinery and wrought iron work, with practical and theoretical experience, desires a responsible position in any part of the country. Ad. M. E., care of the American Engineer, Pontiac Building, Chicago.

CHICAGO, MILWAUKEE & ST. PAUL RAILWAY.

Electric Lighted and Steam Heated Vestibuled Trains, with Westinghouse Air Signals, between Chicago, St. Paul and Minneapolis, daily.

Electric Lighted and Steam Heated Vestibuled Trains between Chicago, Council Bluffs and Omaha, daily.

Through Vestibuled Sleeping Cars, daily, between Chicago, Butte, Tacoma, Seattle, and Portland, Ore.

Solid Trains between Chicago and principal points in Northern Wisconsin and the Peninsula of Michigan.

Daily Trains between St. Paul, Minneapolis and Kansas City via the Hedrick Route.

Through Sleeping Cars, daily, between St. Louis, St. Paul and Minneapolis.

The finest Dining Cars in the World.

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6,100 miles of road in Illinois, Wisconsin, Northern Michigan, Iowa, Minnesota, Missouri, South Dakota and North Dakota.

Everything First-Class.

First-Class People patronize First-Class Lines.

Ticket Agents everywhere sell Tickets over the Chicago, Milwaukee and St. Paul Railway.

The famous Winchester elm, in Boston, recently cut down, was standing full grown in 1660. The last treaty with the Indians was signed under it, and it was the last of New England's historic elms.

CONTRACTS OPEN.

Sealed Proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock p. m., on the 9th day of January, 1892, for all the labor and materials required to complete the Cut Stone Work and Brick Work of the Superstructure of the U. S. Custom House and Post Office building at Newark, N. J., in accordance with drawings and specifications, copies of which may be had on application at this office, or the office of the Superintendent at Newark, N. J. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal. The Department will reject all bids received after the time herein stated for opening same; also all bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in envelopes, sealed and marked, "Proposal for Cut Stone Work and Brick Work of the Superstructure of the U. S. Custom House and Post Office, building at Newark, N. J." and addressed to W. J. EDBROOKE, Supervising Architect.

Sealed Proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock p. m., on the 5th day of January, 1892, for all the labor and materials required for furnishing and erecting complete, the hydraulic passenger elevator, including pump, tanks, piping, car, inclosure of well hole, changes in connections, etc., of boiler plant of the building, changing of fourth-story stairs, and removal and re-construction of water-closet in basement of the U. S. Post Office and Court House, building at Peoria, Ill., in strict accoidance with the drawings and specifications, copies of which may be had at this office, or the office of the custodian at Peoria, Ill. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the bid. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must he inclosed in envelopes, sealed and marked, "Proposals for Hydraulic Passenger Elevator, etc., add removal and re-construction of water-closet in basement of the U. S. Post Office and Court House building at Peoria, Ill.," and addressed to W. J. EDBROOKE, Supervising Architect.

Sewage Pumping Engines.—Sealed proposals will be received by the city of Chicago Office of the Department of Public Works, until 11 a. m. Tuesday, Dec. 29, 1891, for the construction, delivery and erection, upon and within the foundations provided by the city of Chicago, of two "Sewage Pumping Engines" and three boilers, together with the necessary feed pumps, pipes, etc., and complete in all details and particulars for constant daily use in connection with the web well and discharge conduit provided by the city of Chicago.

One engine to have a capacity to raise 12,000,000 U. S. gallons 15 feet high every 24 hours.

One engine to have a capacity to raise 24,000,000 U. S. gallons every 24 hours.

According to plans and specification on file in the office of the department of puhlic works of said city.

Proposals must be made out upon blanks furnished by said office, and be addressed to said department, indorsed, "Proposals for Sewage Pumping Engines," and be accompanied with $1,000 in money, or a certified check for the same amount on some responsible bank doing business in the city of Chicago, and made payable to the order of the commissioner of Puhlic work.

The commissioner of public works reserves the right to reject any or all bids.

No proposal will be considered unless the party offering it shall furnish evidence satisfactory to the commissioner of public works of his ability, and that he has the necessary facilitles, together with sufficient pecuniary resources, to fulfil the conditions of the contract and specifications, provided such contract should be awarded to him.

Companies or firms bidding will give the individual names as well as the name of thc firm, with their address.

J. FRANK ALDRICH, Commissioner of Public Works.

Comptroller's Office,
City of New Orleans,
New Orleans, Nov. 20, 1891.

Sealed Proposals will be received at this office until the hour of 12 m., Thursday, February 18, 1892, for the construction of a new drainage pump, in accordance with plans and specifiations on file in the office of the City Engineer. Copies of plans and specifications will be forwarded hy mail on request.

A deposit of $200 will be required to accompany each bid.

The city reserves the right to reject any and all bids.

All in conformity with Ordinance No. 5753, C. S., adopted Nov. 10, 1891.

F21 Otto Thoman, Comptroller.

Drawbridge.— Competitive plans for a drawbridge across the Duluth ship canal will be received by the board of public works in and for the corporation of the city of Duluth, Minn., until 2 p. m. on the 28th day of Debember, 1891, said plans to be drawn according to notes and specifications for the size and strength now on file in the office of said board, which will be furnished upon application. A cash prize of one thousand (1,000) dollars will be paid for the best plans furnished. Said plans must be accompanied with detail specifications and approximate cost of said bridge. The successful bidder in all probability will, if so desired, be engaged by the city of Duluth when the bridge is built to superintend the building of the same.

Official Seal. Henry Truelsen, President T. W. Abell, Clerk, Board of Public Works.

DECEMBER 26, 1891. The American Engineer. VOL. 22, NO. 26.

THE CHANDLER & TAYLOR CO.'S SELF-CONTAINED ENGINES AND BOILERS.

The illustration on this page represents one of the self-contained engines, having a return tubular boiler, built by the Chamber & Taylor Co., of Indianapolis, Ind. The method of setting is also clearly shown in the cut. For stationary purposes this engine and boiler combination is in great favor with many steam users. And many of our readers have formed favorable acquaintance therewi h.

These boilers are made of steel plates, with longitudinal seams *double riveted*; they are thoroughly braced and subjected to hydrostatic test before shipment. The cut was taken from one of the smaller sized boilers, but fairly represents most of the sizes made.

The boiler fixtures comprise arch front, grates, bearing bar, back plate, back stand, safety valve, steam gauge, water gauge, gauge cocks, whistle, blow-off, check valve, stop valve chimney and guys.

The engine fixtures comprise spanner wrenches, cylinder lubricator, oil cups, drain cocks and governor belt. When the engine and boiler are sold together, steam, exhaust and feeder water pipes, heater and feed water injector are included.

ENGINES FOR WAR SHIPS.

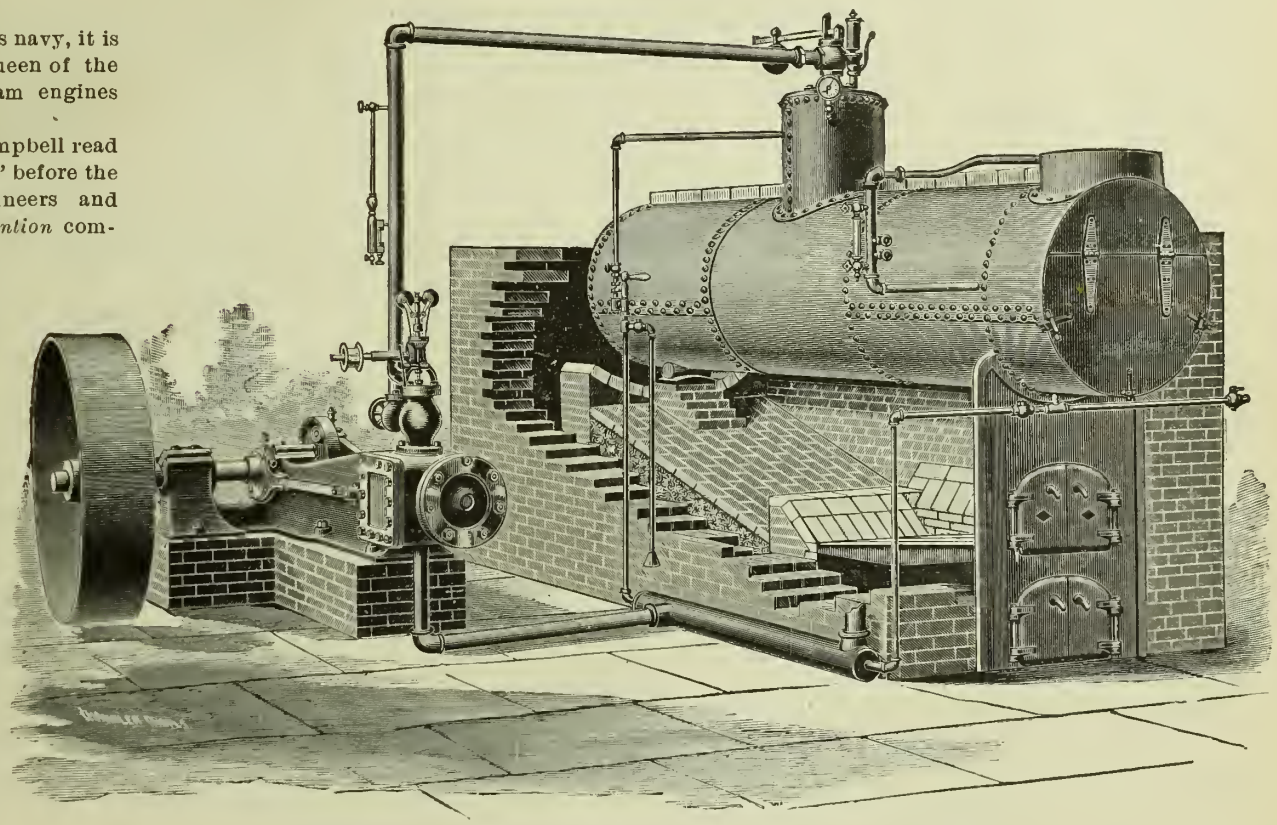
Now that Uncle Sam is building up his navy, it is of great interest to know what the "queen of the ocean" has to say concerning the steam engines desirable for ships of war.

On the 21st ultimo, Mr. J. Jennings Campbell read a paper on "Engines for Ships of War" before the North East Coast Institution of Engineers and Shipbuilders, England, on which *Invention* comments as follows:

To certain propositions and statements made by Mr. Campbell exception may be taken, but his paper was none the worse for this. In his own words, "Its chief object was to produce discussion rather than simply to air his own crotchets," and this, we take it, manifests appreciation of what the primary characteristic of a paper should be. Mr. Campbell thinks that the engines of war steamers are placed at a great disadvantage as compared with those of other ships, in that they have to work not at that pressure which gives the best economical results, but now at a very high, now at a very low pressure, and he questions if under such conditions triple-expansion are better than compound engines. The work done in the low-pressure cylinder at such a speed as 8 or 10 knots in a vessel capable of attaining 19 or 20 knots when hard driven, is little or nothing, and the loss by cylinder condensation becomes relatively enormous. But in practice war ships do very little steaming at high speed, and the consequence is that their engines are wasteful of fuel. "It will easily be seen, then, that the great variations of power required, make it not only impossible to obtain equal economy at all speeds, but may render it most difficult to get real economy at any one speed, and at the same time, a reasonable measure of economy at the others." He draws an instructive comparison between the performance of modern triple and the now old-fashioned compound engines, citing two vessels, the *Briton* and the *Tenedos*, as examples. The *Briton* had 57 in. and 100 in. cylinders, with 2 ft. 9 in. stroke; and the *Tenedos* 57 in. and 90 in. cylinders, with 2 ft. 6 in. stroke. The cylinders were jacketted in both cases, and in the *Tenedos* there was also an arrangement for admitting steam inside the pistons. Both engines were of the return connecting rod type; the *Briton's* being horizontal and the *Tenedos's* slightly inclined from the horizontal. The heating surface in the *Tenedos* was 5,784 square feet; that of the *Briton* was not published, but it is believed to have been about the same. The vessels were practically sisters ships. The engines of the *Briton* were fitted with Cowper's "hot pot;" that is to say, an arrangement by which the steam was re-heated and dried on its way from the high to the low pressure cylinder. Trials were made with both ships in 1870 and 1871. At 10 knots the *Briton* gave as the best results a horse power for 1·35 lb. of coal. The indicated horse power was in both cases about 2,000 horses, the revolutions 99·7 for the *Tenedos*, and 92·6 for the *Briton*. Mr. Campbell not unnaturally asks if any modern triple-expansion engines for a ship of war give as good result at any speed, and we think the answer must be in the negative.

We now come to debateable ground. Mr. Campbell holds that, in the usual practice of admitting steam for $\frac{1}{8}$th or $\frac{1}{4}$th of the stroke in the stroke in the high pressure cylinder is wrong, and would cut off at an earlier point, and make the high-pressure cylinder larger in proportion to the other two than is now the practice, as in this way there would be less "gap" in the diagrams, and a better economical result. We hold, says the *Engineer*, that Mr. Campbell is mistaken, and that the existing practice, being the "survival of the fittest," is really the best. Mr. Campbell is, however, not singular in regarding gap representing loss. The idea originates in the practice of constructing a theoretical expansion curve, calculating its area, and comparing it with the area of the actual diagrams. There are several examples of this method given in the paper, and we find such deductions as "efficiency of steam in high-pressure cylinders, 82 per cent.; ditto in intermediate cylinder, 73 per cent.," in one case; while in another case all the diagrams are placed on the theoretical diagram, and we are told that the actual efficiency is 6.49 per cent. Nothing can more fully exemplify the misleading nature of this method of deducing efficiencies than Mr. Campbell's assumption that the loss of efficiency is wholly due to faulty cylinder ratios. The truth is that diagrams cannot properly be pieced together at all; and that although the gap represents loss of pressure, inasmuch as that loss of pressure is not due to the performance of work, and is attended by an increase in volume, it does not necessarily represent any loss of efficiency at all. It is easy to see that if Mr. Campbell were right, Woolf engines, in which the steam passes directly from one cylinder to the other, should be far more economical than receiver engines. We have in our possession diagrams from Woolf engines which piece so admirably that there is practically no gap, but the engines from which they were taken were not particularly economical. Gap is, however, very often due to cylinder condensation, and then it represents dead loss; but the amount of condensation bears only an indirect relation to the ratios of the cylinders. It is very well known that there is no agreement among engineers as to how diagrams should be placed, and Mr. Campbell himself, after first giving Mr. Schoheyder's method, gives another of his own in which the expansion and compression curves, instead of seeming to be continuous, are considerably stepped, and explains this because it "has the advantage of preventing the mistake so often made of thinking that the three cylinders have one and the same continuous theoretical expansion curve." We congratulate Mr. Campbell on this statement. The mistake is one of every day occurrence. The truth is, of course, that we have in the triple-expansion engine three distinct steam engines, working under very different conditions. The first may be regarded as having during admission an unlimited supply of steam. The other two are placed, the moment admission begins, in the condition of an engine with very large clearance, and no steam available for the performance of work but that which fills the clearance space. It would be as rational to take two diagrams, one from a non-condensing engine working in Birmingham, and another from a condensing engine working in Manchester, and piecing them together on a theoretical diagram, proceed to deduce their efficiencies. If it was certain that the volume filled by the steam at any moment was fixed by the position of the pistons, and by that alone, then it might be possible to piece diagrams; but this is not possible, because the clearance spaces and receivers come into play. Thus, for example, the moment the exhaust port of the high pressure cylinder opens there is a great drop in the pressure, not due to the motion of the intermediate piston, but to the fact that the receiver is at that moment, so to speak, nearly empty. This causes a gap and a fall in pressure, but as we have said, it represents an increase of volume obtained without the performance of work, and it does not necessarily involve any sacrifice of efficiency. The proper method of calculating efficiency consists in preparing from the available data a separate theoretical diagram for each cylinder, and comparing the indicator diagram with it. In a recent impression Mr. Mudd pointed out the important part that cushion steam plays in this kind of calculation, and this very thing may be, and very often is, entirely overlooked in putting cards together.

Mr. Campbell considers at some length the remedy for the evil wrought by the large quantity of water invariably present in the high-pressure cylinders of triple-expansion engines, and he suggests superheating by throttling. He takes an erroneous view of Rankine's celebrated dictum, and assumes that if we let down pressure by throttling, the whole difference in temperature between that of the steam before and after the process will reappear as super-



CHANDLER & TAYLOR CO'S SELF-CONTAINED ENGINE AND BOILER.

heat. This implies that the steam will be as hot after it has passed the throttle valve as before. But this is not what Rankine said. He stated that the sum of the latent and sensible heat of steam at any pressure p, greater than any other pressure p, was also greater by a small amount, and that if the steam at the pressure p was allowed to fall, no work being done, to the pressure p_1, this small excess of heat would serve to superheat the steam slightly. There can be no question, however, but that an economic advantage may be derived from throttling, but it is probably mainly due to the circumstance that a proportion of priming, or rather suspended water in the steam pipe is evaporated at the moment the pressure falls, and in this way the steam is dried before it reaches the cylinder. Mr. Campbell, however, does not confine himself to superheating by throttling, but advocates the use of tubular superheaters of copper in the boiler uptakes. His suggestions on this point are simple and moderate.

After all has been done, however, in this way to promote economy, the fact remains that the engines of war ships are a great deal too large for the power they are normally called on to exert, and he proceeds to consider possible remedies for these adverse conditions. The first consists in working only one engine, permitting the disconnected screw of the other to drag. This he rejects, for obvious reasons. The second method involves the use of four sets of machinery instead of two—only two to be worked at low powers—as in the *Lepanto*, which enormously increases the expense and complication. A third plan is to use three screws, as in the U. S. Cruiser No. 12, and run one, two or three screws, according to the power needed. This is not a commendable method. That which seems on the whole best "consists of fitting ordinary twin-screw triple expansion engines, but with the low-pressure cylinder placed forward, and with a disconnecting coupling between its crank and those of the other two cylinders. With this arrangement it becomes possible to work the engines with triple-expansion at the higher powers, and as double-expansion compound engines at lower powers. Of course it is necessary to have the exhaust pipes of the intermediate-pressure and low-pressure cylinders so arranged and fitted with valves that the former can exhaust direct into the condenser, and the latter be shut off both from the condenser and the intermediate-pressure cylinder. By this method we not only have engines of, say, half the low-pressure cylinder capacity for cruising speeds, but also capable of working at lower pressures than could be satisfactorily employed when working triple-expansion. The only trouble with this type of machinery would be the wearing down of the after portion of the shafting when the forward cylinder was disconnected; as in the case of double engines to each screw shaft. There seems little doubt, however, that this difficulty could be overcome by a suitably designed coupling." There is another method which he does not mention, which seems to us to be the simplest, if not the best. It consists in reducing the pressure, by wiredrawing or otherwise, and taking steam direct into the intermediate cylinder, which, with the low-pressure cylinder, works as a compound engine. The high-pressure cylinder is fitted with a large air-valve on the valve chest, and another on the exhaust, and the high-pressure piston by its motion simply inhales and expels air. The waste of power would be very small. The advantages are that the wear and tear would remain unaffected. No special coupling would be required, and the only addition to the engine would be three valves, one to admit air, and two others, which might be combined, to permit air to exhaust and to prevent the escape of steam from the intermediate pressure valve chest.

The paper concludes with a consideration of various types of engine frame, the author preferring cast iron of really first-rate quality to steel or wrought iron pillar frames. It seems strange that no one has suggested the use of wrought iron or steel plate frames, built up into box girders for large engines. In the present day there would be little difficulty in welding such frames up, but they could be put together with rivets. The success which has attended the use of them in steam hammers, under peculiarly trying conditions, leads us to think that they would be found satisfactory in marine engine practice.

MECHANICS MADE EASY.

By Prof. F. A. Smith.

(*Continued.*)

A body is said to be in uniform motion when it travels through equal spaces in equal times. This would be the motion of every body if an impulsive force set it in motion as it would then by virtue of its inertia continue moving in a straight line with uniform velocity forever, if there were no opposing force. But as every moving body meets with resistance, such as gravity, friction, etc., it must soon come to a stop unless acted upon by continuous force. A continuous force produces uniform motion when it is exactly equal to the resistance. So a train will move uniformly if the power exerted by the locomotive exactly balances the friction and resistance of the air. The earth also revolves on its axis in uniform motion and this motion has been made the standard whereby we measure time; by dividing the time of one revolution in 46,400 parts called seconds, which is considered the unit of time and also the common standard for velocities of all other moving bodies. If a constant force acts upon a body the resulting motion will be varied and is either accelerated when the space traveled in each succession becomes larger, or retarded when the space becomes smaller each second. If a constant force is acting alone upon a body the resulting motion is always uniformly accelerated. A falling body is a good illustration of such motion. The falling, as we know, is caused by the attractive force of the earth which is a constant force making the motion of the falling body uniformly accelerated. The momentum of a body is equal to the product of its weight into its velocity; if for instance, an engine weighing 50 tons has a velocity of 44 feet per second (30 miles per hour) then its momentum would be $44 \times 50 = 2{,}200$ tons or 440,000 lbs, which means that its momentum is equal to a mass weighing 440,000 lbs., moving one foot per second. This explains that the momentum of a moving body depends on two things, namely the velocity and the weight, and accounts for the fact why collisions of heavy trains are so destructive even though they are moving slow. Laws of motion have been determined by the eminent scientist Newton and may be expressed as follows:

1. Every body continues in a state of rest or of uniform motion in a straight line unless acted upon by some external force. This first law has already been explained and is virtually the common property of all bodies called inertia.

2. Motion, or a change in motion is proportionate to the impressing force and is in the direction of the line in which that force acts. This law is also a self evident truth and needs no further explanation.

3. Action and reaction are always equal and are in opposite direction. This law will require some explanatory comments. If a ten pound weight is suspended from a hook, the gravity will try and pull the hook out with a force of ten pounds; this is the action; but the hook resists with an equal force and no motion results, this is the reaction. When a pugilist strikes another his fist sustains as great a shock as it gives, but is usually less sensitive to injury and pain than the part on which it strikes.

When a moving body encounters another, the effect of action and reaction are modified by elasticity and other conditions. Let us first consider unelastic bodies, for instance two balls of clay, one weighing 5 lbs. and the other 4 lbs.; we will now suppose the 5 lb. ball at rest and the 4 lb. ball striking it with a velocity of 10 feet; the effect will be that both balls will move with equal velocity in the direction in which the 4 lb. ball was moving before the collision; but the momentum of the two balls after collision must be equal to the momentum of the 4 lb. ball just before it strikes. This is equal to $4 \times 10 = 40$, therefore, since the combined weight of the two balls is 9 lbs. their velocity after the collision is $40 \div 9 = 4.9$ feet per second.

If we next suppose the two clay balls striking each other traveling in opposite directions we can easily determine the result. Let the 5 lb. ball for instance have a velocity of 6 ft. and the 4 lb. ball a velocity of 7 ft, the momentum of the former is 30 and of the latter 28; hence when the collision occurs the momentum of the 4 ft. ball is annihilated by the destruction of 28 momentum units of the 5 lb ball leaving just 2 as the resulting moment for the two balls in favor of the 5 lb. ball. The result will be therefore a motion in the direction of the 5 lb. ball and since the momentum equals 2 the velocity after collision equals 2-9 feet.

We will next consider elastic bodies. In perfectly elastic bodies the force of elasticity is exactly equal to the compression and in such bodies the effect of reaction is the same as that of action. In order to illustrate this farther we will suppose that we have two ivory balls instead of clay balls. If now the 4 lb. ivory ball strikes the 5 lb. ball at rest the entire momentum, which is 40, will be used up in compression the 5 lb. which in turn requires immediately a momentum of 40 and consequently will move with a velocity of $40.5 = 8$ ft. per second in the direction in which the 4 lb. ball was traveling before collision. If these two ivory balls are colliding traveling in opposite direction, the 4 lb. ball with a velocity of 7 ft. and the 5 lb. ball with a velocity of 6 ft. per minute, then as before an interchange of the moments takes place, the 4 lb. ball acquires the momentum of the 5 lb. ball = to 30, and will therefore rebound with a velocity of $30.4 = 7\frac{1}{2}$ ft. velocity while the 5 lb. ball acquires the velocity of the 4 lb. ball = 28, and rebounds with a velocity of $28\text{-}5 = 5$ 3-5 ft. per second.

The foregoing illustrates well the mechanical effect of motion in colliding bodies, the first example showing non-elastic bodies and the second perfect elastic bodies. But since we have neither perfectly non-elastic nor perfectly elastic bodies we must in considering them observe to which class they properly belong and then either treat them as approximately perfect elastic.

PUMP RULES.

See that your pump has a full supply of water.

In pumping very hot water, always arrange to have a head that will "flood" the pump.

Never use pipes of a smaller size than that given in the tables; if your line of pipe is very long, increase the diameter to provide for increased friction, especially for the "suction" or supply pipes.

Doubling the diameter of a pipe increases its capacity four times.

The friction of liquids in pipes increases as the square of the velocity.

Avoid turns, angles, using as few as is possible, run all lines of pipe in a direct line, when possible. Bends, returns and angles increase friction more than length of pipe.

To find the pressure in pounds per square inch of a column of water, multiply the height of the column in feet by .434.

Each nominal horse-power of a boiler, requires 30 to 35 pounds of feed-water per hour.

The ordinary piston speed for pumps is 100 feet per minute.

To find quantity of water raised in one minute, piston speed being 100 feet per minute; square the diameter of water cylinder in inches, and multiply by 4. *Example*—Capacity of a five-inch cylinder wanted. Square of diameter is 25, multiply by 4, gives 100, which is gallons per minute (approximately).

To find horse-power necessary to elevate water to a given height, multiply the total weight of column in pounds by the velocity per minute in feet, divide the product by 33,000; allow 25 per cent for friction, etc.

The Doctor.

A STRANGE MATERIAL.

A prospector in Montana has found a strange mineral that takes fire and consumes itself when exposed to the air. When taken from the ground it has much the appearance of iron ore and is quite as heavy. The first that was taken out was piled up near the shaft one evening and the next morning was found to be smoking. It continued to grow hotter until it arrived at almost a white heat, remaining in that condition several days, after which it gradually cooled off. It was then found to be but half its first weight, and resembled much the fragments of meteors that are found on the surface.

The temperature of man is $98\frac{1}{2}$ degrees, that of fish 77 degrees.

THE J. R WEBBER MOULDING FACTORY.

The Laclede Council, A. O. of S. E., No. 1, St. Louis, Mo, prides itself in having its men holding the best positions in that city. The J. R. Webber moulding factory stands second to none in the whole world, in the moulding business; and the accompanying illustration conveys a better idea than any words can give of the magnitude of this famous factory. It is one of St. Louis' leading business houses. And the corresponding engineer of Laclede Council, Bro. J. W. Wood, is the chief engineer of this great factory.

The J. R. Webber Moulding Co., says Bro. Eben B. Hill, who has sent us the information herein setforth, can show a record hard to beat. The president, Mr. J. R. Webber, was for eleven years a member of the Scarritt Furniture Co., and had charge of manufactnring and wholesale departments. At that time the wholesale furnitnre dealers handled mouldings, etc., and Mr. Webber's success attracted the attention of a large moulding factory, and he was induced to make a change, and he went into the moulding bu iness. He became connected with the moulding factory, but did not remain there long. He withdrew in order to start a bnsiness of his own.

It was in 1882 that Mr. Webber started "on his own hook," commencing in a small way. But by the end of two years his bnsiness had outgrown his quarters; and being compelled to have more room, he leased a large building (60x150 ft.) at the corner of Broadway and Chamber street, St. Louis.

In 1889 Mr. Webber prganized a stock company, with a capital stock of $25,000, to take control of his rapidly increasing business. And the business went on increasing so immensely that they were obliged to look for larger premises, and they decided to bny a lot and build a factory of their own.

In April last, the company secured the elegant lot, corner of Twenty-first street and Cass avenue, and at once proceeded to erect the large factory (shown in the accompanying cut), which is acknowledged to be one of the most complete in the country. The buildings have a frontage of 125 feet on Cass avenue. The front building is four stories high. The offices are on the first floor of this building, as well as the sample room and shipping department. The second floor is used entirely as a stock room, and the third floor is occupied by compo moulding.

The gliding department is on the top (that is the fonrth) floor, and there the goods receive their finishing touches. A fine elevator runs from top to bottom of the factory, and the building is heated with steam, and lighted throughout with electricity.

The front and rear buildings are separated by an alley-way 18 feet wide, and connected by bridges on each floor.

On the first floor, in the rear building, are the moulding machines, saws, etc. There the moulding is first cut out of the rough lumber. On the upper floors the mouldings are prepared for the finish, and there the frame sawing is done, etc.

Adjoining the mill building is the boiler and engine room, which is 25x42 feet. The power plant there consists of a boiler, made by Rohm Bros., 48″x22′ with 12 6″ flues, having a working pressure of 100 lbs., together with a Buckeye engine 10″x14″ which makes 245 revolutions per minute, as well as a Laidlaw & Dunn Co.'s duplex pump, and a Stillwell & Bierce Co.'s heater.

Mr. J. W. Wood, corresponding engineer of the Laclede Council, A. O. of S. E., is the chief engineer, as already stated, and he is proud of his position and performs his duties most creditably. In another column we give his picture and his "pedigree."

The Webber company place full confidence in the ability and fidelity of Engineer Wood. They sought his advice concerning the whole plant, and nothing was done in the engineers' department without consulting him. The purchasing of machinery, and the placing and setting up was all done subject to his approval and directions. Consequently everything runs very smoothly and without a hitch. He has adopted the Jenkin's globe and angle valves; and he uses his exhaust steam for heating the building. All the refuse from the moulding machines are blown into the shaving house adjoining the boiler room by a shaving blower.

When anything was needed he always consulted the advertisements in The American Engineer, and has found all purchased therefrom first-class.

A MASTER OF ELECTRICITY.

Anybody who has heard much about the work of Professor Elihu Thomson, the man whose name is in the title of the great electric company, and whose brain has worked out the mechanical ideas that have made the company tremendously rich and famous in the last decade, is very much surprised usually when he meets the little professor.

The man of genius is only about 5 feet 4 inches high, or perhaps a little taller. His figure is even boyishly slight, and his face is very much younger in appearance than that of almost any man with a mustache in the senior class at Harvard University. His no account brown mustache gives him an older look, but if it were not for that he would be startlingly youthful looking. As it is, he is a few years short of forty.

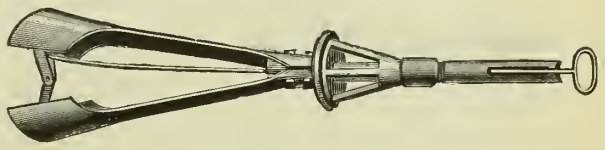
He was always famed for his precocity, and he had to wait two years before he could enter the high school in Philadelphia, because he was too young. He was a professor of chemistry before he was 23 years old. When he was 11 years old he began experiments with Leyden jars, and continued experiments in electricity uninterruptedly until he was 13 years old. He lived in Philadelphia, and when he'd try his 'prentice hand on his first dynamos he used to travel into the woods away from home to strip the elderberry bushes, and get the pitch to make insulating material with.

When he'd be short of this he'd get from the neighbors the silver foil from tobacco and use that. He ought to be worth hundreds of thousands of dollars to-day, but he is comparatively poor, and he devotes his energies to the supervision of the technical electrical works of the company exclusively. Professor Houston, the man whose name is coupled with his in the title of the company, is not directly connected with the concern, but is a plodding professor of physics in Philadelphia.—*St. Louis Globe-Democrat.*

THE CHAMPION FLUE SCRAPER.

The cut in this column is that of the "Champion" flue scraper, placed on the market by Mr. V. Radspinner, of Peoria, Ill. Mr. R. L. Lukens is the general sales agent, with offices at 53 south Jefferson street, Chicago, where the scraper itself may be seen.

It is claimed that the "Champion" will cut and remove all hard scale or crustation formed in the flues of a tubular boiler; and that it is the only scraper that will remove scale formed in water flue boilers, such as Heine, Babcock, Zell or Root. It will perform the same work in locomotive or traction engines.



The Champion Flue Scraper.

It is also maintained that 25 per cent will be saved in fuel, as well as time and cost of repairing flues, by using the "Champion" Scraper, and that by its proper use the flues will last as long as the shell of the boiler. And finally it is said that the scraper itself will last twice as long as any other cleaner, while doing better work.

This scraper is in use by the United States government. And we notice that the highest premium was awarded to the Champion Flue Scraper by the Centennial Exposition of the Ohio Valley and Central states, at Cincinati, in 1888.

The *London Times* has completed the publication of a series of four articles, aggregating nine columns about the Exposition, from the pen of Joel Cook, of Philadelphia, who is the chief representative of the "Thunderer" in the United States. Mr. Cook visited Chicago a short time ago and informed himself thoroughly upon Exposition matters. His first article, which is replete with statistics, is devoted almost wholly to Chicago as a city, and is a glowing account of its wonderful history and its achievements and attractions. The second treats of the plan and scope of the Exposition, including data and descriptions of the buildings. The third represents the present condition of the enterprise as to work of construction, etc., and contains also at some length the favorable conclusions drawn by Sir Henry Wood, the British commissioner who recently visited Chicago in the interest of his country's participation in the Fair. The fourth and concluding article treats of the railway journey to Chicago from New York and other Atlantic ports, representing that it is a delightful trip and that it will interest the foreign visitors scarcely less than will Chicago and the Exposition itself. Altogether Mr. Cook's articles are exceedingly favorable to the Exposition and appearing as they do in such an influential paper, will unquestionably do it an immense amount of good, not only in London and throughout England, but in all parts of Europe and in the many British colonies all over the world.

The American Engineer.

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CONTENTS OF THIS NUMBER.

ARTICLES:

CHRISTMAS has arrived once more, being the twelfth since THE AMERICAN ENGINEER commenced its career. We heartily wish all our friends a Merry Christmas. A year rolls by in "no time." But the index, presented herewith, to the 22nd volume (which closes with this issue) shows that we have "redeemed the time" as it flies, and that our editorial mill has been grinding incessantly. We have reasons for believing that our labors have not been in vain. Those who have read our columns from week to week, have been kept posted concerning improvements in engines and boilers, and new devices in steam appliances, as well as in electrical science. It is gratifying to know that our work is appreciated, and bears fruit in the edification of our numerous readers, whose numbers have increased considerably during the past ten weeks. Our advertising columns are also in increased demand, and we believe that the new attractive advertisements in this and recent issues are only an earnest of a large volume of business which is coming our way, as a result of the new life that is being infused into this well-known journal. For some years past it has maintained the even tenor of its ways without much effort. But from this time forth THE AMERICAN ENGINEER is to run in the front rank of profcssional journalism, and has for its chief aim the elevation of the steam engineering profession and allied industries. We return thanks to our correspondents and contributors. And again we wish one and all a Merry Christmas.

JOURNEYMEN STEAM FITTERS.

The profession most nearly related to that of steam engineers is the working steam fitters' occupation. Strictly speaking, the engineer should produce the steam, and it is the steam fitters' place to fix up all the steam pipes and make all the necessary connections.

Too often the engineer is called upon to be steam fitter as well. Where the steam plants are small, the engineer may be steam fitter also; but where the engines and boilers demand an engineer's whole attention, he should be relieved from work that may distract his thoughts.

The professional steam fitter's avocation calls for special studies, and his own particular work is enough for him to attend to, if he is to do his work in a thorough and efficient manner. A Jack of all trades is a master of none, is a true saying, and worthy of consideration in this connection. If an engineer atteuds to his engine properly he cannot afford to "waste time" on the steam fittings of the establishment, otherwise his mind may become too divided to do one thing or the other well.

It is a great mistake to overtax the energies of an engineer, or any other man. Senator Plumb has just died at Washington, through overwork. And many a locomotive engiueer has been so overworked as to be totally unfit to hold his responsible position.

For a man to keep his equilibrium it is necessary for him to eat well, sleep soundly, have a clear conscience, and not have too much to do. A steam fitter is the stationary engineer's friend; he relieves the engineer from work that does not properly belong to him. And in this age of sub-division of labor, the steam fitter supplies a "much felt" want.

Owners of steam plants will find it is the truest economy to have each man fill his own place, aud no more, and that it will be cheapest in the long rnn to have a steam fitter as well as an engineer, instead of insisting that the engineer should do the work of the two. Of course when one plant is not large enough to take up the entire time of a steam fitter, two or three (or more) establishments may join togcther to have a competent man to attend to the steam fitting department in each house.

BOILER EXPLOSIONS.

A saw-mill boiler exploded at Ridgeville, Ind., Dec. 17, killing three, including the engineer (George Wise, aged 35), and injuring four others. The killed were all badly mutilated. A correspondeut says: "Too much steam pressure on the boiler is supposed to be the cause."

A telegram from Springfield, Mo., Dec. 19, says: A boiler being used by some stone contractors near the new Baldwin Theater on St. Louis street exploded this morning, killing Engineer Philip Davis, Assistant Engineer Robert Baer, and fatally wounding George Crews, laborer. The explosion was caused by turning a stream of cold water into the boiler, which was hot and almost empty.

SCIENTIFIC PROGRESS IN 1891.

Dr. Robert Grimshaw, the well-known consulting engineer and scientific expert, of 21 Park Row, New York City, is preparing a record of Scientific Progress during 1891, to be published by the Cassell Publishing Co. Those who know of anything specially noteworthy in scientific lines during the year now drawing to a close are invited to send the particulars to Dr. Grimshaw.

RULE FOR OBTAINING CONTENTS OF A BARREL IN GALLONS.

Take diameter at bung then square it, double it, then add square of head diameter; multiply this sum by length of cask, and that product by .2618 which will give volume in cubic inches; this, divided by 231, will give result in gallons.

NEW YORK has been coaxed to unite with the rest of the United States—and the whole world—to make the Columbian Exposition a great and successful World's Fair, in 1893.

WATER RAMS IN STEAM PIPES.

BY CHARLES E. EMERY, PH. D.*

The bursting of a steam pipe in the U. S. S. *Concord* has brought out considerable discussion as to the cause of the accident. The writer of this article says, in the *Journal of the American Society of Naval Engineers*, that the principal cause of accidents in the operation of large, long steam pipes arises from the presence of water.

If steam be admitted at the top of a vessel partially filled with cold water, condensation will take place until the surface is somewhat heated, and this, in connection, with a cloud which forms above the surface, will retard rapid condensation, so that in due time the full steam pressure can be maintained above water cold at the bottom. This phenomenon is not an infrequent occurrence in boilers in which the circulation is defective. It is therefore perfectly safe to heat up any vessel containing cold water, if the steam can be admitted from the top upon the surface of the water and so maintained. If, however, steam be blown in from below the surface of the water, a bubble will be formed, which will increase in size until its surface becomes sufficiently extended to condense the steam more rapidly than it can enter, when a partial vacuum will be created, the bubble will collapse, and the water flowing in from all sides at high velocity will meet with a blow forming what is called a water ram. In blowing into a large vessel these explosions occur in the middle of the mass, and create simply a series of sharp noiscs. If, however, steam be blown into a large inclined pipe full of water, it will rise by difference of gravity to the top of the pipe, formiug a bubble, as previously stated; and, when condensation takes place, the water below the bubble will rush up to fill the vacuum, giving a blow directly against the side of the pipe. As the water still further recedes the bubble will get larger, and move farther and farther up the pipe, the blow each time increasing in intensity, for the reason that the steam has passed a larger mass of water, which is forced forward by the incoming steam to fill the vacuum.

The maximum effect generally takes place at a "dead end," as it is called, or where the end of the pipe is closed. Even if the water does not orginally extend to the "dead end," if the pipe near it be once filled with steam which has bubbled through water on its way to that point, there may be sufficient cold metal to condense it, so that the collapse will take place on the same principle as before, and the whole mass of water in the pipe be driven by the incoming current of steam against the end, sometimes with tremendous force, the effect being to cause leaks, and sometimes rupture the pipe or break out the end connections. It is not necessary, either, that the end of the pipe be closed. In fact, under certain conditions, a more forcible blow is struck when the end of the pipe is open, as, for instance, when a pipe crowned upward is filled with water, one end being open and the steam introduced at the other. A bubble will in due time be formed at the top of the crown, when the water will be forced in by atmospheric pressure from one end and by steam pressure from the other, and the meeting of the two columns frequently ruptures the pipe. Evidently, too, the same action can occur without difficulty in a level pipe, but, as previously stated, cannot in a pipe which descends away from the entering steam, so that the latter is *always* above the water.

It is evident from the above that it is always desirable in turning steam on an inclined plane to introduce it from the top, and let the water out of the bottom of the slope. When this can be done, any workmen can be trusted to attend to it. Frequently, however, there are undulations in the pipe, and at times mains which may contain water have to be heated by letting the steam in the lower end, and letting the water out before the steam is admitted. The same thing can be done with underground pipes, and provisions for this should always form a part of the plans when it is known that a pipe will have to be heated up in this way.

In practice, however, a street system contains so many absolutely necessary details that a provision of this kind will not be originally provided for and at times it will occur that a main which it was

*In *Cassier's Magazine* for December.

expected to heat from the top of the slope, may, from something being out of order, necessarily be heated from the other direction. Difficulties also occur in small pipes where the extra labors and expenses required to provide special drains for overcoming this difficulty would not be warranted, particularly as another solution of the difficulty is available, even with pipes of considerable size.

If a blow-off opening be provided at one end of a main to be filled with steam, even if such blow-off be at the higher end, any water in the main can be driven out of the blow pipe, provided the steam valve be opened sufficiently wide to keep the pressure continuously maintained against the water. The explanation of this is that if the steam supply be limited the water will run back under portions of the steam, forming bubbles which may suddenly collapse and produce water rams; but if the steam supply be practically unlimited, or at least sufficient, the steam will force the column of water back along the bottom of the pipe, as vacuum formed will be filled by the steam driving back the water. There will be a series of small explosions, which will scarcely be heard and do no harm, and the seething wall of water will be continually forced forward and finally out of the pipe.

Note the distinction in the two methods of operation necessary to suit the conditions. When the steam is on the top of the water, it may be turned on as slowly as desired, and it is better to turn it on slowly, as thereby the heavy castings are heated slowly, and are not so liable to be strained. But when steam *must* be turned in the lower end of a descending pipe which *may* be filled with water, the valve must be opened sufficiently to establish a definite current and keep up the pressure. This will not require the valve to the wide open, but the result will be substantially as though it were open Practical engineers, who on sea and land have had to do with turning on steam in pipes, naturally recoil from turning steam quickly into any pipe, and it is very hard to explain to them the difference. I have had to take a party of men of this kind, state the reasons for action, and in one case I recollect using as an illustration, that if a farmer with a pitchfork could get an officer on the run, the latter could not draw his sword, turn, and defend himself, as he would be run through before he came to close quarters. The principle applies to the water in an ascending pipe. The column of water once started, the steam, if the supply be made sufficient, follows it up so closely and in such volume that no condensation can take place sufficiently to stop the onward movement.

The clearing of a pipe in this way requires nerve and judgment, but I have seen considerable cold water driven up hill out of a six-inch pipe 1400 feet long with a difference of elevation at the two ends of fully twenty feet, by letting steam in the lower end and blowing the water out on the street through a two-inch blow-off pipe. The blow-off pipes are made no larger than this, even for mains fifteen and sixteen inches in diameter, but I do not consider that it would be safe to attempt to clear an ascending main of this size with this size of blow-off pipe. All these mains are more nearly level, have blow-offs at low points near the valves, and can be blown off by putting steam in at or near the summit. In heating up an eleven-inch pipe, only 400 or 500 feet long, from the bottom, I have had the flange taken off the extreme end in order to give water free exit and prevent the possibility of a ram.

Mr. Takahira, Japanese Consul-General in New York, who was specially commissioned by the Mikado to look into Exposition matters, has made a formal application to Directer-General Davis, for 124,100 square feet in the several buildings and on the Midway Plaisance as follows: For an official Japanese building, 40,000 square feet; in the Manufacturer's Building, 35,000; Agricultural building, 4,000; Fine Arts, 2,000; Mines and Mining, 750; Forestry, 350; Bazaars, 42,000. Mr. Takahira was formerly secretary of the Japanese legation at Washington and speaks English fluently. He says the Japanese are greatly interested in the Exposition and will soon make a very large appropriation for participation.

ENGINEERS are in a state of transition from the unsatisfactory past to a better future.

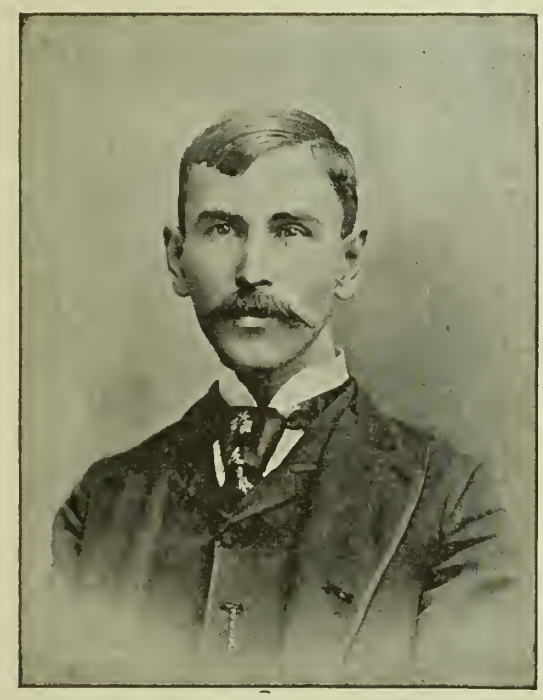
OUR FRIENDS.

VIII.—J. W. WOOD.

Mr. Editor:—I enclose a photo and a short biographical sketch of Bro. J. W. Wood. He was born in St. Louis, in October, 1860. Consequently he is 31 years old. He was educated in the public schools, to a limited extent.

His first "calling" was that of a farmer. But farming was not congenial to his inclinations; so he returned to St. Louis, and drifted into the occupation of fireman. He fired for three years, during which time he kept his weather eye open and cut his wisdom teeth. He studied steam engineering and became acquainted with the operations of the engine, both by obseration and practice. The engineer left the engine very much in fireman Wood's charge, and one day the engineer forgot to put in an appearance at all.

The engineer having left the firm without any notice, they called upon Bro. Wood to take his his place. Before taking charge he went before the St. Louis inspectors, passed his examination successfully, and received his license. He has been with the same firm ever since; that is the J. R. Webber Moulding Co., whose factory is illustrated on page 257.



J. W. WOOD.

Bro. Wood is a total abstainer, using neither liquor nor tobacco in any form. He is a married man, and he and his wife are very happy in the possession of two children—a boy and a girl.

E. B. H.

BOILER EXPLOSIONS IN ENGLAND.

A report to the Secretary of the Board of Trade on the working of the Boiler Explosions Acts, 1882 and 1890, during the year 1890-91, has just been issued as a parliamentary paper, which is summarized in *Invention*. From this it appears that during the 12 months ended June 30 last., 72 boiler explosions were reported to the Board of Trade, and were dealt with under the provisions of the Acts mentioned. By these explosions 32 lives were lost and 61 persons were injured. Under the provisions of the Boiler Explosions Act, 1890, the operation of the Act of 1882 has been extended to two classes of boilers which had previously been exempted—namely, the boilers of certificated passenger steamships and boilers used in or about coal and metalliferous mines. During the year three of the former and seven of the latter class were dealt with. In 22 cases formal investigations were held. The results of these were usually the censure of the responsible persons, who were, in many instances, ordered to pay costs. In 18 cases the boilers which exploded had been inspected either on behalf of insurance companies, or by Lloyd's, or by the Board's surveyors in connection with the survey of steamships for passenger certificates. In all but three of these cases the explosions were due to causes other than defects which periodical inspection should have revealed.

THE CRUISER "NEW YORK."

The largest war ship of the United States navy, so far, has been launched, and named "New York." Her dimensions, and especially a description of her engines and boilers, as well as electrical equipments, will no doubt be read with interest.

Before she received her name the New York was known in the Navy Department as armored cruiser No. 2, the Maine having been No. 1. Her construction was authorized by the Naval Appropriation act approved Sept. 7, 1888. Bids were advertised for under date of April 8, 1890, and a circular to builders issued defining the chief characteristics of the vessel. On June 10,1890, the contract for the construction of the vessel was awarded to the William Cramp & Sons Ship and Engine Building Company. The contract provided for the completion of the vessel by January 1, 1893. The first delivery of material for her construction was made on Sept. 3, 1890, and the first keel plates were laid on the blocks on September 30 of the same year. Fourteen months have been consumed in the construction of her hull.

The principale dimensions of the vessel follow:

Length on the water line	380 ft. 6.5 in.
Breadth of Beam	64 ft. 10 in.
Mean draught	23 ft. 3.5 in.
Displacements	8,150 tons.
Maximum speed	20 knots.
Sustained sea speed	18.5 knots
Complement (officers and men)	475.
Coal endurance (total capacity)	13,600 miles.

Her cost, exclusive of armor and armament, will be $2,985,000. If, during her trial trip, she makes more than the guaranteed speed of 20 knots for four consecutive hours, her builders will receive a bonus of $50,000 for each quarter knot so made. The Cramps received $135,600 for the excess above the guaranteed speed of the Philadelphia, and $183,124.50 for the excess of the Baltimore, Yorktown and Newark. It is confidently expected by experts that no small bonus will be gained by the Cramps on the New York. The total cost of the vessel will be in the neighborhood of $3,000,000.

The frames of her hull are of steel, covered with steel plates. Her stem, stern-posts and shaft struts are immense pieces of cast steel. The rudder frame is a combination of forged and cast steel, and the rudder, complete, weighs 35,000 pounds. She has four complete steel decks—upper, gun, berth and protective—besides a flying deck or bridge, upon which are carried the boats, Yellow pine flats are laid over the upper and gun decks, 2¾ inches thick, and over the berth deck, 2½ inches thick.

She will have no sail power, but will be provided with two military masts, fitted with double fighting tops for machine guns and revolving cannons.

Her fire board to the upper deck is 20 feet, and together with her size, will enable her to fight her guns and maintain her speed in the sea which would render smaller ships practically helpless.

The New York is now a little over two-thirds completed, but she looks more. All of her outside plating is on, the superstructure on the upper deck is in place, and the decks are nearly all laid. Nearly all of the bulkheads are complete, and, in fact, nine-tenths of the metal work is done, and most of the wood and other fittings. Her deflective armor, that is, the protective deck, is nearly finished, but the side armor has not yet been received. It and all of the machinery will be put in place after the vessel is launched.

The four great engines have been erected in the shops, and are to any one not a mechanic a wonderful and attractive complication of huge steel frames and rods. To an engineer they are an artistic and intelligible embodiment of immense power and force. The six boilers are standing on the wharf, practically completed.

The vessel has twin screws, 16 feet in diameter, driven by the four separate engines, of 4,000 horsepower each. Two of these will work the starboard shaft and two the port shaft, and they are so arranged that they may be disconnected and the vessel run under half power.

The engines are of the vertical, inverted, direct-acting, triple expansion, three cylinder type, and arranged in four water tight compartments. The cylinder diameters for each engine are 32 inches for the high pressure, 46 for the intermediate and

70 for the low pressure. The stroke is 42 inches. The air and circulating pumps are driven independently.

There are four main condensers of composition and sheet brass, each having about 5,560 square feet of cooling surface, and two auxiliary condensers.

It is estimated that the total collective indicated horse-power of propelling, air pump and circulating engines should be 16,000 when the propelling engines are running at their maximum speed, 129 revolutions per minute.

The main battery of the New York consists of six eight-inch breech-loading rifles, 35 calibres in length, which will fire an ogival projectile of 250 pounds weight. The recent trials of nickle-plate armor, at the proving grounds on the Potomac river, showed the terrible execution these projectiles can do. Twelve four-inch rapid firing guns are the powerful auxiliary to the main battery.

In addition to these there will be mounted at advantageous points about the decks and aloft four six-pounders, four three-pounders and four one-pounders, all rapid fire guns, with four 37 millimetre revolving cannon and four 45 calibre machine guns. No person unfamiliar with the power of such an armament can form a good idea of the terrific storm of shot and shell that these guns can fire. Concentrated on a single defensive work, the execution would be such as to destroy almost everything before it. Besides these guns, the vessel will have six torpedo tubes.

Of the 8-inch guns two will be mounted in a barbette forward on the upper deck and two in a similar barbette aft, while the remaining two are carried in broadside amid-ships on the upper deck.

The barbettes forward and aft, on which the eight-inch guns are mounted, are 10 inches thick, and the revolving conical shields over the guns are seven inches thick. The sloping armor between the upper and gun decks beneath the barbettes is five inches thick, and the ammunition tubes have also a thickness of five inches.

The main feature of the armor of the New York is the protective deck. This is complete, and extends from bow to stern, over the machinery and hold spaces. It is horizontal throughout the length of the vessel for a width of from 10 to 25 feet, and the sides slope down to the skin of the ship, forming a slight angle which will deflect any projectile that happens to penetrate her side. The protective deck is literally an almost convex shield of armor. The edges of the contour meet the sides of the ship 4 feet 9 inches below, and the highest part is 1 foot above the water line when the vessel is at the mean draught of 23 feet 3½ inches.

This deck is completely covered with two courses of plating, having a thickness of three inches amidships and two and a half inches forward and aft. The slopes amidships are covered with an additional thickness of three inches, making their total thickness six inches. Beneath this six inches of armor are the boilers and engines, the vital and propelling powers of the ship, which, of all her equipment, should be most protected from damage by shot and shell.

Abreast from the machinery spaces is the side armor, a thin belt of nickle steel worked between the protective and berth decks. It is $3^{7}/_{8}$ inches thick, and the total thickness of metal on the side throughout this space is five inches.

Six double-ended horizontal return fire-tube boilers will furnish steam at a pressure of 160 pounds to the square inch. Eight furnaces will heat each boiler, and they will be arranged two abreast in three water-tight compartments, with six thwartship fire-rooms. These main boilers will be 15 feet 3 inches in diameter and 21 feet 3 inches long. They will have a total grate surface of 990 square feet, and a total heating surface of 31,190 square feet.

Above the protective deck two auxiliary single-ended two-furnace boilers will be placed, having a total grate surface of 64 square feet and heating surface of about 1,937 square feet. All the boilers are fitted to be worked under forced draught on the air-tight fire-room system.

It is believed by experts that the arrangement of the engines is such as to show great economy at low speeds, and it is estimated that on the total bunker capacity of 1,500 tons of coal the vessel will have an endurance of about 13,000 miles at a speed of 10 knots.

Every modern improvement in plumbing, drainage and fittings have been introduced, and great care taken to have all arrangements thorough and efficient. There are fittings for artificial ventilation throughout, and the living quarters have excellent natural ventilation as well.

The vessel has a complete electric lighting outfit, consisting of five sets of dyuamos and engines, with a capacity of 1,000 amperes, and will include 700 incandescent lights. There will also be four search lights, 30 inches in diameter, all of which can be controlled from the bridge and conning tower.

The vessel is fitted as a flag ship, and, in addition to the quarters of Admiral and Captain, there are state rooms for 20 ward-room officers, 12 junior officers and two warrant officers. The usual storerooms are provided, and the quarters for the crew are roomy and comfortable. The size and type of the vessel are such as to make the accommodations throughout surpass those of every other vessel of the navy for spaciousness and comfort.

There have been five other vessels in the United States Navy named New York, nearly all the largest and most powerful of their class. The first was a gondola used for service on Lake Champlain. No. 2 was a frigate of 1,130 tons and 36 guns. She was commanded at different times by Captain R. V. Morris and Captain John Rodgers. After considerable service in the Mediterraneau she laid at the Washington Navy Yard some time, at which place she was broken up.

The third was a sloop used in bay and river service from 1812 to 1815. She was captured by the British. No. 4 was to have been an 84-gun line-of battle ship, the largest of her class. She was building at the Norfolk Navy Yard when the civil war broke out, and was burned. The fifth was to be called the Ontario, but 1869 her name was changed to New York. She was never launched, but in 1888 was broken up, the Government deciding to build its vessels of steel.

The present "New York" was christened by Miss Helen Paige.

HARVEY THE "MAGIC CITY."

The Harvey Land Association, as appears from their advertisement in the American Engineer, invite manufacturers, and others to locate at Harvey, the "magic city." The location is splendid, the inducements are great. Several manufacturers have already availed themselves of the opportunity. And as a final attraction the discovery of a "great gusher" is described, as follows in the Harvey *Tribune*.

A GREAT GUSHER.

Not since the day that Moses smote the rock in the desert and brought forth a gushing fountain has Harvey seen such a flow of the aqua pura as witnessed at the works of the Harvey Transit Company Friday evening of last week. The company had been for weeks vigorously driving a well in order to secure a supply of water sufficient to meet the wants of a city of 20,000 population, but not until the drill penetrated a bed of sand at the depth of 2,075 feet were their wants realized. On withdrawing the drill a stream of pure soft water gushed up some two feet out of an eight-inch pipe. A smaller nozzle was attached, and the pressure of the subterranean river pushed the stream some twenty feet in the air. The company paused to breathe and to begin to realize what good luck they had come across, and the liquid fountain proceeded to deluge the surrounding country. The news spread like the water, and soon all Harvey was rejoicing over the invaluable find. This is indeed a great boon, for with plenty of fresh air, fresh, pure water, both for drinking and all purposes, our citizens have much to be grateful for. It is safe to claim that there is not another similar well in Cook County. Just score another one for the Magic City.

A Connecticut man owns a big horse. He is nearly seven feet high and weighs 1,700 pounds. His appetite corresponds to his size. He has eight pecks of oats at each meal, if you can believe a local chronicler.

THE STATIONARY ENGINEER.*

By Leonard A. Blake, Ann Arbor, Mich.

Engineering, generally speaking, is that art of designing and superintending the execution of works of a constructive character, such as roads, bridges, harbors, railways, canals, docks, works for supplying water to towns, drainage and sewerage works, mining machinery, and the working of metals. But we shall deal with that distinct profession which is said to have originated about the middle of the last century. From that time the improvements in the steam engine by James Watt for raising water by means of the expansive force of steam, its subsequent application to the railway system by George Stephenson, and its first successful adaptation to navigation by Robert Fulton have given to civilization and commerce a great impulse, which in their turn have created a necessity for the wonderful magnificent, and numerous engine works of the modern times.

Indeed, steam engineering has assumed such large proportions that it has opened a field for a profession the boundaries of which are hard to define. It requires a wide range of scientific knowledge to understand and explain the laws of nature involved in the performance of the engineer's daily work. There always has been and probably always will be two classes of mechanics,—those who stand at their benches and go through the manual motions of their work like automatic machines, with little more conception of why the results are as they are; and the other that class of men who make no moves without knowing the why and wherefore of, results, and the relative importance of each step. This, the mechanical education that schools the mind to a clear comprehension of the principles, equally with details, and leads unfailingly to that higher field where diligence, marked ability, and skill find their natural level.

Just so with the two classes of engineers,—practical and theoretical engineers. Our practical men sneer at our theoretical men, and *vice versa*. While we have men in our profession who would shed luster on calling, we have many who are very slack in the real knowledge so essential to their profession, and often this last requirement is the cause of the frequent recurrence of accidents, by which so many lives are sacrificed and property wrecked, although not always, as carelessness and poor machinery have a great deal to answer for. Carelessness is too often the cause. In May of 1889 the DesMoines courthouse had a narrow escape from an explosion. The night man left the fire burning low. When the day man came on in the morning, he commenced firing up strongly. Not noticing the stage of the water, he went home to breakfast in about an half an hour's time, leaving a heavy fire. In his absence some of the domestics needed some hot water in the kitchen and opened the valve for that purpose, but could not get any. On investigation the boiler was found to be empty and red hot, with all the flues burnt loose.

It is a great mistake to intrust the care and management of machinery to persons of inferior judgment. A competent engineer can often save three or four times his wages in knowing how to take care of the property intrusted to his care. Just what capabilities a so-called competent engineer should possess would be more difficult to enumerate than those he should not. The engineer, like the physican, must always be qualified for business. In most other occupations the workman sticks to his line: a broommaker will do nothing but make brooms, but the engineer's line covers a wide range.

Not every engine has had an indicator applied to it to show its condition, but there is always one, two, three, or more indicators on every engine that shows the skill and worth of the engineer. Is your engine clean? Are your oil-cups clean and free from dust? Is there no baked grease around the lubricator connections? Is your engineer kind, courteous, obliging? Does he always ask your opinion with a willingness to learn? Or is he gruff, lazy, and greasy, telling you he is no book engineer, but a *practical* engineer, not knowing that these practical men are often a nuisance to the profession: their minds are too small and cramped to accept the enlightenment needed in this progressive age. There is little excuse for ignorance on the subject while so many

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books are accessible at a trifling expense,—books written by engineers who devoted years to their noble calling, and animated by a desire to bequeath to posterity the knowledge they acquired in order that the *art* of engineering might advance on intelligent and well-defined alignments.

If the practical (?) man referred to would devote a portion of his leisure hours to study and follow a regular systematic course of self-culture, he would eventually acquire advantages that would enable him to compete with men who have had all the facilities of an early education and might then say, as the Kansas minister said, "I have been a far more useful man since the Lord revealed to me that I was never to be a great man," and he would have learned that no man is practical unless he has proved practice with theory and theory with practice.

I remember reading in an engineering publication, shortly after the Johnstown flood, an article saying that much comment had been occasioned among engineers of this country because President Moxham, of the Johnstown Rail Company, had sent a cablegram to Manchester, England asking for another engineer to take the place of a Mr. Lewis, who was lost in the flood, as their engine was one of the Galloway make and had to be reversed at a given point, or a great deal of awkwardness would be occasioned. Luckily for the American engineers, he was able to find one engineer who had run a similar engine, and so the Englishman did not have to pack up and come to a country where there are scores of men who, although they had never seen an engine of this kind, could have overcome the difficulty in far less time than it takes to cross the Atlantic.

An engineer should be possessed of natural talent, not necessarily be a machinist. I think but few of our great inventors such as Watt, Stephenson, Fulton, Stevens, Evans, and many others, were machinists.

James Watt, we can almost say, was the inventor of the steam engine; at all events, the improver. He was twenty-three years of age before his attention was called to the capabilities of steam as a motive force.

Robert Fulton was first apprenticed to a jeweler; afterward he became a painter of portraits, and later of landscapes. His versatility at length inclining him to mechanics, he devised and patented the inclined plane, invented a mill for sawing and polishing marble, a machine for spining flax, and one for making rope. The small steamboat that he built and its successful propulsion by the newly-understood power are facts of interesting historical moment and marked the inception of the most significant era in the industrial world.

George Stephenson (his biographers informs us) was humbly born. At the age of fifteen he was appointed fireman in an English colliery, where he applied himself to the earnest study of the steam engine. All through his early life we find a record of a struggle between a determined purpose, industry, sagacity, and the great drawback, poverty. He invented the colliery safety-lamp. he constructed the first locomotive, and soon after he was made director of 214 miles of railroad, involving a capital of £5,000,000.

In a stationary engineers' handbook occurs this statement: "The very nature of steam engineering calls for superior intelligence in those on whom depends the care and management of steam machinery. Engineers should therefore prepare themselves for any casualty that may arise, by considering possible cases of derangement and deciding in what way they would act should certain accidents occur."

In my place I have not at present all the time I would like for such comprehensive reflection, as the introduction of two new engines, one boiler, and two dynamos recently (the engines being new for the work to which they are adapted) require unusual attention, but the plant is working with increasing smoothness day by day, and careful observation of its several characteristics will probably eventually suggest new ideas of practical moment.

No man who loves exact knowledge can fail to find a scope for the exercise of his intellect in the calling of an engineer, as it is adapted to men of the most opposite temperaments. Two conditions alone are needed: The man must love his work, and have ability to perform it.

CORRESPONDENCE.

A New Use For Chaintongs.

Editor, American Engineer:

A few days ago I received a heavy loaded car which was placed about 30 feet from where I wanted it. The brake beam was so low that a car mover would only move the car about 1 foot at a time. I sent an assistant for a pair of 4 foot chaintongs and applied them to the axle, and with ease we moved that car a foot at a time.

As every steam user should have a pair of chaintongs, it will answer the two purposes and make a better car mover. If you think it worth while mentioning to the boys, in our valuable paper, do so.

H. R. Leigh.

Mechanics and the Wilson Line Holder.

Editor, American Engineer:

I have read the contribution of Prof. Smith and "The Doctor." It seems as if they were going to say something about "Mechanics," but they are a long while coming to their text. Why don't they tell us something useful, such as how to build an engine foundation that will do away with all vibration; how to run an elevator without jerking; how to consume smoke; how to ventilate an engine room down in a basement where one never feels the benefit of a breath of fresh air; or how to make a governor govern an ungovernable engine, or something really useful.

All that they have said so far can be found in books, and in better shape than the scraps they give. We, engineers, read the American Engineer watching for something new—something that has been discovered in practice.

Bro. Wilson, of Nebraska, has given us something new in a lining tool. I, for one, should like to have a fuller description of this device. And I spoke to a neighbor to see if he could understand the Wilson line holder sufficiently, from the article you published, to enable him to make one. He was not clear about it, and could not enlighten me on what I could not understand. And as many others may be interested, perhaps Mr. Wilson will oblige by giving further particulars. Information like this makes a paper valuable.

As the Wilson line holder is not patented any one can make a tool of the kind for himself, I take it. In fact, it is so stated in the article already pulished. But I should like to know, further, if a firm or an individual may be at liberty to manufacture the device wholesale, that is to make them in large quantities and sell them at a profit?

J. S. O.

A. O. of S. E. Enquiries.

Editor, American Engineer:

As a member of the A. O. of S. E. I wish to ask a few questions. Will you, or any Brother Engineer, who is posted, kindly answer the same?

1st. I was one of several brothers, who were anxious to buy the whole of The American Engineer in place of one-third, and were ready to pay the full assessment for same; and I understand that some of the Councils *did* pay a part of their assessment, but for only one-third interest, thus carrying out the contract made by our Order, as one of three parties who had contracted the same.

The American Engineer Publishing Co. showed their good faith by standing by this same contract. Now, what I wish to know is; How can our Supreme Chief, Jefferson Young, Jr., rescind this contract, made in good faith, without notifying the Supreme Council of his intention, and obtaining their consent?

2d. If he did notify the Supreme Council, can you tell me why that body neglected to notify the Subordinate Councils that a meeting had been called and such important business transacted?

3d. Suppose the Supreme Chief and Council *do* rescind their contract by declaring the contract broken, or by any other means, can the Subordinate Councils that paid in their assessments in part payment for said one-third of American Engineer, collect the same; or, in other words, don't the Councils cancel their right to any moneys paid by them to the American Engineer Publishing Co. when they rescind their contract?

4th. As I understand it, the American Engineer Publishing Co. stands willing to carry out their part of the contract. Now, if this is so, why should the A. O. of S. E., as a body, rescind a contract that has not been broken by them or the Publishing Co?

5th. Has the Supreme Chief the power legally to rescind an obligation that involves the financial interests of several Subordinate Councils, without first consulting said Subordinate Councils? If so, kindly inform me how he gained it?

John Holmes.

FROM OUR TRAVELER.

Mr. Editor:—While on this trip I called on Bro. Harry Calliuson, of John E. Sweet Council, of Syracuse, N. Y. Harry is one of the good-natured kind of people who are always glad to see a visiting brother, and will always make it pleasant for him. He kindly invited me to remain over and visit the Council, which I did, and was present at the nomination of officers.

It is a pleasure to attend a Council of the A. O. of S. E., where everything is conducted on strict parliamentary rules.

The regular work passed off smoothly, for John E. Sweet council is one of the star councils of the Order. Then the favorite names were submitted for consideration.

The choice of the Council on final ballot was as follows. Officers for 1892.

Past Chief Engineer, C. A. Halbritter.
Chief Engineer, J. H. Benedict.
First Asst. Eng., Frank Pfohl.
Financial Eng., W. W. Bust.
Treasurer Eng., Chas. Ginkel.
Senior Master Mech., C. Nobles.
Junion Master Mech., N. Kinne.
Chaplain, Geo. Edinger.
Inside Sentinel, C. Thompson.

It is very evident from the remarks I heard on all sides that the choice of the new officers was entirely satisfactory, and all went home satisfied with their night's work. In conversation with the Syracuse brothers, I find that they are enthusiastic over the license question, recognizing the fact that our protection lies in securing legislation on this matter in every state in the Union.

It is now settled among the members of this enterprising Council, that a license for their city will soon be in their grasp, and each member deserves credit for the untiring persistency shown in their endeavor to stop the Tramp Boiler Burster from destroying life and limb.

I dropped in unexpectedly on Bro. Ben. Kane, the royal entertainer of Buffalo, No. 14, and found him busy at work in his engine room. It makes me think of old times to call on "Old Pop" (as the boys call him.) We are old friends and can talk over old times as none but old timers can. He informs me that the license law will be adopted in Buffalo; this is a victory I am sure.

Our Bro. Harris, of Oregon, No. 1, is making some improvements in his ice-berg engines. I know that the brothers will be pleased to hear that this Council from the far West is booming, adding new members, which are slowly but surely commanding the best situations in this thriving western city.

W. S. Ladd has just completed a new bank building and equipped it with electric machines, elevators, steam heat, and all modern improvements and placed the same in charge of Bro. Lynch, one of the most useful members of Oregon No. 1, A. O. of S. E. I congratulate Mr. Ladd in securing for his new building the services of our Bro. Lynch. Although young in years, he has proved himself to be a first-class engineer, genial, good-natured, and a credit to our Order, and I am sure that the boys will join me in extending to him, as well as Oregon No. 1, the best wishes, success, and prosperity.

I am also pleased to hear from another member of this Council, Bro. W. L. Francis, who is always ready to assist any of the boys from his unlimited supply of valuable knowledge. And right here, let me inquire about our chief engineer, I. G. Cunningham. It is now some time since I heard from him, and Bro. Harris, as "Cor. Engr.," has not called the attention of our Worthy Chief to the columns of the American Engineer, else I should have seen some

important suggestions from the capable pen of Bro. Cunningham. But I will watch for his reply, as I am anxious to hear from him once more.

While speaking of Portland No. 1, let me thank Bro. B. S. Castell for the interesting items that he has kindly addressed to the editor.

I am going on a trip through Illinois and Ohio and shall call on all the boys along the line.

Fraternally yours,

On The Wing.

QUESTIONS AND ANSWERS.

Winding the Magnet Coils.

An "American Electrician," of Salem, Ore., asks a second question, as follows:

If one wire is wound down and then back to the starting place, will it not make the magnet neutral?

In reply we would say that, as long as the direction of the winding remains the same it makes no difference how the layers are put on, and the coils may run back and forth as often as necessary. In other words, the method of winding is immaterial, provided always that the current when flowing from the positive to the negative terminal of dynamo or battery, always goes around the iron core in the same direction. If this is so done, each turn of the wire will add to the strength of the magnet.

"J. S. R." Indianapolis, Ind., asks:

A Point of Responsibility.

1. Who is responsible for the defects of a new engine?

It admits of no question, we should think, that the engine builder is responsible for all defects of construction. The purchaser does not share the responsibility, even after he accepts an engine, if he was not aware of any defect; but after being aware of something wrong he becomes responsible unless he protests against the defect. This last point, however, is a moot question: for some jurists hold that the purchaser becomes wholly responsible after he accepts an engine, and that he ought to discover any defects which may exist while a failure to make the discovery does not relieve him of responsibility.

The Straight Line Engine.

2. A friend of mine recently fixed a Straight Line engine: a certain side of the piston had to be put uppermost; why would it not work equally as well either side up?

In a Straight Line engine, the piston must be put a certain side up, because the piston rings do not go all the way round, and the space which they do not cover, must be placed on the bottom.

THE JINERS.

She was about forty-five years of age, had black hair, rather thin and tinged with gray, and eyes, in which gleamed the fires of a determination, not easily balked. She walked into the mayor's office and requested a private interview, and having obtained it, and satisfied herself that the law students were not listening through the keyhole, said slowly, solemnly, and impressively:

"I want a divorce."

"What for? I supposed you had one of the best husbands," said the mayor.

I s'pose that's what every body thinks; but if they knew what I've suffered in the past ten years, they'd wonder I hadn't scalded him long ago. I ought to, but for the sake of the young ones I've borne it, and said nothing. I've told him, though, what he might depend on, and now the time's come; I won't stand it, young ones or no young ones, I'll have a divorce, and if the neighbors want to blab themselves hoarse about it they can, for I won't staud it another day."

"But what's the matter? Don't your husband provide for you, don't he treat you kindly," pursued the mayor.

"We get vituals enough, and I don't know but he's as true and kind as men in general, and he never knocked any of us down, I wish he had, then I'd get him in jail, and I know where he was of nights," retorted the woman.

"Then what is your complaint against him?"

"Well if you must know, he's one of them plaguey Jiners."

"A what?"

"A jiner—one of them pesky fools that's always jining something. There can't nothing come along that's dark, and sly, and hidden but he jines it. If anybody should get up a society to burn his own house down, he'd jine it as soon as ever he could get in, and if he had to pay for it, he'd go all the suddener. We hadn't been married more'n two months before he joined the Know Nothin's. We lived on a farm then, and every Saturday night he'd come tarin in before supper, grab a fistful of nut cakes and go off gnawing them, and that's the last I'd see of him till morning. And every other night he'd roll and tumble in his bed, and holler in his sleep, 'put none but Americans on guard—Geo. Washington,' and rainy days he would go out in the corn-barn and jab at a picture of King George with an old bagnet that was there. I had ought to have put my foot down then, but he fooled me so with his lies that I let him go on and encouraged him in it.

Then he jined the Masons. Perhaps you know who'm be, but I don't, 'cept they think they are of the same kind of critters that built Solomon's temple; and of all the nonsense and gab, about worshipful master and square and compasses and sich like that we had in the house, for the next six months, you never see the beat. And he's never outgrowed it neither. What do you think of a man squire, that'll dress himself up in a white apron, about big enough for a monkey bib, and go marching up and down, and making motions and talking foolish lingo at a picture of Geo. Washington in a green jacket and apron covered over with eyes and columns and other queer pictures? Ain't he a loonytick? Well, that's my Sam, and I've stood it as long as I'm goin' to.

The next lung the old fool made was into the Odd Fellows. I made it warm for him when he came home and told me he had jiued them, but he kinder pacified me by telling me that they are a sort of branch show, that took in women, and he'd get me in as soon as he found out how to do it. Well one night he came home and said I'd been proposed and somebody black-balled me. Did it himself of course. Didn't want me around knowing about his goings on. Of course he he didn,t and I told him so.

Then he jined the Sons of Walter. Didn,t say nothing to me about it, but sneaked off one night, pretendin' he'd got to sit up with a sick Odd Fellow, and I never found it out, only he come home lookin' like a man who had been through a threshing machine, and I wouldn't do a thing for him until he owned up, and so its gone from bad to worse, jining this, that, and to'ther, till he's worshipful minister of the Masons, goodness of hope of the Odd Fellows, sword swallower of the Finnegans, and virgin cerus of the Grange, and Grand Mogul of the Sons of Indolence, two edged tomahawk of the United Order of Red Men, tale bearer of Merciful Mainkins, and skipper of the Guild Caratine Columbus, and grand Oriental Bouncer of the Royal Arcaners, and big wizard of the Arabian Knights, and pledged passer of the Reform Club, and chief bulger of the Irish Mechanics, and purse keeper of the Order of Canadian Conscience, double barreled dictator of the Knights of the Brass Circles, and standard bearer of the Royal Archangel, and sublime porte of the Union League, and chief butler of the Celestial Cherubs, and puissant potentate of the petrified pollywogs, and goodness only knows what else. I've borne it and borne it, hopin' he'd get 'em all jined after awhile, but 'tain't no use, and when he'd get into a new one, and been made grand guide of the Nights of Horror, I told him I'd quit and I will."

Here the Mayor interrupted, saying:

"Well, your husband is pretty well initiated, that's a fact; but the court will hardly call that a good cause for divorce. The most of the societies you mention are composed of honorable men with excellent reputation. Many of them, though called lodges, are relief associations and mutual insurance companies, which, if your husband should die, would take care of you and would not see you suffer if you were sick."

"See me suffer when I'm sick! Take care of me when he's dead! Well, I guess not, I can take care of myself when he's dead, if I can't I can get another! There's plenty of 'em! and they needn't bother themselves when I am sick either. If I want to be sick and suffer, it's none of their business, especially after all the suffering I've had when I 'aint sick because of their goin's on. And you needn't try to make me believe its all right, either. I know what it is to live with a man that jines so many lodges that he don't know enough to lodge at home."

"Oh, that's harmless amusement; quietly remarked the Mayor.

She looked him square in the eyes and said: "I believe your a jiner yourself."

He admitted that he was to a certain extent, and she arose and said: "I would not have thought it. A man like you, chairman of a Sabbath school, its enough to make a woman take poison! But I don't want anything of you. I want a lawyer that don't belong to nobody or nothin"

And she bolted out of the office to hunt up a man that wasn't a jiner.

CUFFY'S CHRISTMAS.

Black Cuffy had come, in the blue beard's trains
When the tender leaves were jeweled with rain,
When the daisies, were sparring the hedge and field
And the pastures gay with the clover yield,
When rank upon rank the green cane stood,
In the violet bank, of the swampy wood.

Whose boy was he? there was no one who knew,
Any more than whence came the birds of blue
While he, with a laugh, or a sigh, would say,
"I'se Cuffy, and I 'longs to 'de broad highway,
Just as 'de bubble, belongs to 'de spring,
Or 'de fiddle-bow to 'de fiddle string,
I'se happy as a squirrel in a hickory tree,
For me and my fiddle, was both born free."

'Twas Cuffy who knew where the sweet plums grew,
Where the brown thrush built or the birds of blue
Who could tell you the name of an herb or flower,
And find you the spring in the mossy bower,
Who dared to climb for the mistletoe white,
As it hung far up in the wintry night.

When the church was decked and left in the night,
And the cabins were full of ruddy light,
And the women were busy with loving hands,
As they talked of Christ, and his Angel-Bands
Who had sung from the north, east, south and west,
That the earth was still, and at perfect rest,
For Jesus, his Son, had come from above,
To bind it to God, with a cross of love.

Cuffy listened, with face and heart aglow,
And he raised his fiddle and poised his bow,
And swifty he patted his small brown feet
And told to his fiddle a secret sweet.
Whispered it down to the little brown thing
As though there was life in its every string.

Then away he sped to the church in the bend,
Where he laid his cheek to his trusty friend,
And drew such strains from its tender strings,
That the night bird hushed its whiring wings,
Gayly he played all the tunes that he knew,
From "Home, home, sweet, sweet home,"
To "Cheers for the Red, White and Blue."

Gayly he whistled, and gayly he sang,
Till the echoing pines to the music rang,
Then he touched the strings with a tender grace,
"Lord Jesus," he sang, "Let me see thy face,"
"Lord Jesus, its 'dy birthday, let me see 'dy face,"
Then with bow half drawn he paused in surprise,
And lifted to Heaven his wondering eyes.

For Lo', where the morning star is in sight,
Stood Jesus, the Child of the Christmas night.
He stood with his feet on the great white star,
While the Angel Host shone down from afar,
Sweet was the vision, that answered his song,
But sweeter the smile, that the Lord let fall on Cuffy
As he stood with his half drawn bow,
That night by the church where the pine trees grow.

He had brought his gift to the Master's feet,
Of humble songs, that were caught in the street,
So simple the gift, so great was the grace,
For he saw while he sang, the Christ-Child's face.

THE WOMEN'S DEPARTMENT

Peace on Earth.

Peace on earth. Oh, tender message
Sent to us this Christmas morn!
We may fling aside the burdens
That have made us weak and worn,
For an all-sufficient Saviour
On this holy day is born!

Peace on earth! Oh, blessed tidings!
Words of comfort, words of cheer!
As we lift our songs of praises,
Listening with the spirit's ear,
Seems it that an answering echo
From the halls of Heaven we hear!

Peace on earth! Oh, glorious gospel!
Let all rancor slip away,
All dissentions, bitter broodings
Be forgotten, that there may
Only be, as Christ would wish it,
Peace on earth, this Christmas-day!

—*Susie M. Best.*

Christmas Etiquette Notes.

Christmas presents should not be made an obligation; there should be an independence of donor and recipient. It takes a great deal of common sense and independence to accept a costly present from a rich friend, without making any return. And yet what has been no sacrifice for her to make might be an extravagance and sin for you to return. In such a case, it is not only bad morals but bad manners to attempt to give a present of any value.

If your friend has means and wishes to show her affection for you by the purchase of some costly gift, you can best return it by some needle work of your own, a photograph, or any small token of one's thought.

If you have money to spend on Christmas presents, do not waste on people who are richer than yourself, but upon those who are *poorer*, or in equal circumstances, or upon children who recognize no obligation, and thank Santa Claus for all.

The sending of Christmas cards has been so much overdone, that in the last few years people of taste have ceased sending them, except in the form of photographs. One can find a large assortment of photographs (unmounted) of famous pictures and people. These can be bought as cheaply as a Christmas card, mounted at *home* and sent to friends at Christmas as a simple reminder of your thought, and yet at the same time something which by Valentine's Day will not be so much waste paper. To a musical friend, a photograph of Mozart, Mendelssohn or Wagner; to a friend who is fond of painting and artists, the head of Michael Angelo Leonardo, or Raphael, or some copy of some of the great masterpieces. These come in small sizes and may give your friend for the first time an acquaintance with a great work.

Above all, in sending Christmas presents do not send plush boxes, dozens of scent bags, or articles that cost money and are vulgar and tawdry. A good book, a piece of new music, to friends who like to exchange ideas with you. To others a note written on Christmas day, wishing many happy returns, or a few flowers, entail no obligation, require no work, and do their own work of love as well as costly gifts, and show a delicacy of breeding.—Marie Lauryer Hamlin in *The Ladies' World.*

Vassar's Pin-Money Fund.

Vassar is the only woman,s college in the country that has a pin-money fund. Some good old New-Yorker donated a certain sum for a "free fund" not long ago, to be used for fun exclusively. Every year there are a few girls in the college who are actually penniless. They have sufficient brains to secure the free scholarship, and depend on their darning baskets for the fees that cover incidental expenses. All through the year parties are made up for lectures, concerts, operas, readings, field sports, and excursions about the country. These trips cost money, and the girl who hasn't any may draw on the "Pin-Money Fund" for her expenses, and nobody but the "Lady of Vassar" and the Treasurer will be the wiser.

The College Woman's Expenses.

A well-bred, intelligent, and refined girl undergraduate, who could not be called in any sense either a frivolous or a fashionable woman, insists that it is impossible for a college woman to meet the demands of study, personal progress, personal comfort, and personal popularity on less than $365 a year, besides the essential expenses of tuition clothing, board and lodging. One-third of this amount is required to cover the gracious courtesies extended to friends—courtesies which according to her idea, are in a measure obligatory and included in the price of popularity. The girl is what men would call a college "swell," yet the obligations of her high place costs her papa just about one-half or one-third the amount it requires to enable her brother to maintain a similar place of prominence in Yale, Harvard, or Princeton.

On the other hand, plenty of girls cover all expenses outside of tuition on a smaller amount than this. A dollar a day is considered a fair allowance by the ambitious girl student with which to keep the wolf from the door. She shares a room with two or three of her companions, feasts off crackers, cocoa, eggs, cereals, and similar inexpensive food which she prepares herself over a gas stove as large as a teacup, and with an occasional luxury in the line of a beefsteak or oyster patty keeps well and happy on her small allowance and even indulges in an occasional "spread" of taffy, or olives and eclaires.

In spite of the traditional theory of woman's extravagance it will be found on investigation that a girl lives better and more comfortably on a small income than a man can, and while the man invariably owes his entire quarter's allowance to satisfy the last quarter's creditors the girl is never in debt. Rarely does the college woman find herself in debt at the close of her university course, but many a woman graduate turns her old gowns and teaches dead languages to help the man she marries pay off the college obligations incurred years before he saw her.

What Should a Woman Be?

We would have her gracious and gentle,
With a kindness to walk side by side
With sympathy's smile for the sunny,
With sympathy's tear for the tired.

We would have her tender and truthful;
A voice with sincerity's sound,
And, above every act of her earth-life,
These virtues to ever abound.

With the air of the earnest and thoughtful,
Which can merge into merrier words,
And win with her warmth and wisdom,
All persons her presence includes.

With a spark of the fire of the fearless,
That can frankly and firmly defend
The right in its hours of oppression,
And steadily stand by a friend.

With a conscience so carefully cultured,
And of such a delicate mold,
That naught of a doubt-tainted nature
This crystalline chalice could hold.

We would have her womanly always,
With th' coyness that close to her clings;
For to be a womanly woman,
Is the crown of all womanly things.

We would wish her fervent and faithful,
Faithful and found to the end;
And, strange tho' it seem, I have found these,
Aye, all of these—in a friend.

—Josie Frazee Cappleman in *Detroit Free Press.*

An Unjust Appeal.

There is a continual appeal from women that justice be done them by men, and a corresponding overlooking of the fact that it is from among the ranks of women that their most bitter opponents are too often to be found. Men have an inherent respect and appreciation for honest work, both mental and physical, and will not deny the results of it, no matter whose work it is; but with women there is a wide difference. With them there is an entire lack of appreciation of labor as labor. The reason for this is good: Women have rarely worked or lived collectively as men have; consequently their life has always been an individual one, and peculiarly so as far as their work is concerned. They may do the same work that their mothers have done before them, but at the same time it is purely personal, where their surroundings are more or less what they make them.

In the case of men no career is open to them where they are not surrounded on all sides by co-workers, striving for the same goal, with whom they must match their best powers of body and mind. All the while the men watch each other closely, so that if one is successful they may imitate his methods, and if unfortunate avoid his stumbling blocks. Thus they do their work under the eyes of their fellows subjected to their criticisms at every turn.

All this is absolutely foreign to women's experience, for hitherto they have worked as the individual not as the class.

It is always difficult to see both sides of a question, but what women most need is the impartial judgment of their work, as work done, not as women's work."

There is no possible doubt that women will have to learn to accept a certain amount of loss of consideration which has heretofore been shown to their personality, and assume at the same time a responsibility of mistakes which it must be feared they are sure to make while in the act of adjusting their lives to the changed conditions in which they have elected to place themselves.

The fact can not be ignored that there is a deplorable lack of sympathy between the women who work and those who do not. For as women are more emotional and sympathetic then men, they are also more prone to intolerance where they are not in accord. Among men there has ever been a certain community of interests; politics for example, where they meet on common ground, and where they learn to measure their power as fractions of a unit. Women have not yet become accustomed to being a part rather than a whole, for while they may, each one, be the slave of some one man, it has been as an individual and not as a fraction. So their position has always been positive, never negative, no matter how sharply the limitation of their free agency was marked, or how contracted the area allowed compared with that which is now conceded.—Anna W. Reading, in *Chautauquan.*

A Cure for Malaria.

A reputable and honored citizen living on the North Side in the vicinity of Lincoln Park had a terrible experience yesterday.

His wife became suddenly ill and he immediately called up the family physician by telephone.

Subscriber—My wife complains of a severe pain at the back of her neck and occasional named.

Doctor—She must have malaria.

Subscriber—What's the best thing to do?

At that moment the young lady at the central station altered the switch by mistake and the unlucky husband received the reply of a mechanical engineer in answer to the inquiries of a mill-owner regarding his boiler.

Engineer—I believe she is lined with excoriations to a considerable thickness. Let her cool during the night, and in the morning before firing up take a hammer and pound her vigorously. Then get a garden hose, with strong pressure from the main, and let it play freely on the parts affected.

The doctor may count on at least one fat patron short.—*Chicago Inter-Ocean.*

How some Young Women may bring Joy to Young Men's Hearts.

"I wish that I could whisper a little Christmas present suggestion into the ears of about 2,000 young women friends of a like number of young men whom I know," remarked one of Chicago's oldest and biggest laundrymen the other day to an acquaintance. "Many of those 'young women' might decline to act on the suggestion that I would make, but nevertheless I would feel I had done my duty, and I venture to say that fully half of them would have enough confidence in my judgment to fall in with the idea, notwithstanding it's a very homely

one. I know—by a certain sort of reputation—of fully 2,000 young men who are clerks, bookkeepers, etc., who dress quite stylishly, so far as outward appearances go, who for many a week past have been wearing fearfully 'holy' stockings. In two-thirds of the cases these young men have been going with more holes than hose. For the life of me I can't see how, in a big majority of instances, they keep the rags on. Doing so must result in their feet continually undergoing tortures indescribable. Toes and heels all gone—gone far into the middle. It makes me feel as though I was stealing when I charge these young men full price for laundrying their socks.

"On the other hand, if I should make a reduction it would necessitate an explanation, and that would cost us their patronage, sure. Now, my heart is bent upon doing these 2,0 0 young men a kind Christmas favor. The favor, if I only knew how to do it, would be to whisper into the ear of the 'best girl' of each of them the suggestion that she buy her young gentleman friend a half dozen or a dozen pairs of good quality hose. Not silk hose, for we laundrymen—to acknowledge a truth—are death on silk. I would supplement my suggestion with another to the effect that under no circumstances should the young women allow her love to know where the socks came from. Send them perfectly 'blind' and you can be assured that they will result in his feelings so much more comfortable for several weeks afterward that her chances for theatre tickets, confectionery, flowers, etc., will be increased a hundred per cent., for the better 'the fellow' feels the better 'the girl' fares, every time.

LITERARY NOTES.

Scribner's Magazine for January begins the sixth year and eleventh volume of this periodical, which now announces a circulation of more than one hundred and forty thousand copies monthly (which is constantly increasing, they say.) The plans for the new year include, besides the more purely literary contents, remarkable series on the Poor in the world's great cities; Important historical moments, by eminent men who took part in them; Out of door papers; occasional railway articles on rapid transit, Australian railways, speed in locomotives; on important water-ways, like the Nicaragua Canal, and the water-route from Chicago to the ocean; also travel, exploration, and abundant fiction, including the notable serial "The Wrecker," by Robert Louis Stevenson and Lloyd Osborne. The first number of the year which promises so much interesting material is particularly beautiful in its illustration, containing another of the Blashfield articles in which that artist's best work is shown; examples of the work of Low, Vedder, and Cox in the group of papers on American illustrators; pictures by Eugene Morand, a French artist new to an American audience, and reproductions of sketches in chalk by Washington Allston. Of particular interest to lovers of art and literature are the articles on "Paris theatres and concerts," by William F. Apthorp; "Bayreuth revisited," by H. E. Krehbiel; "American illustration of to-day," by W. A. Coffin, and "Some unpublished correspondence of Washington Allston."

In line with the conditions of the studies of the poor is a remarkable article by Recorder Smyth, of the city of New York, who is probably the most famous criminal judge in this country. His paper, entitled "Crime and the law," is a clear statement of the safeguards which in the present practice of New York State law protect the innocent and bring the guilty to justice. Recorder Smyth makes three or four specific suggestions which are in the line of philanthropy. He also discusses the origins of and the conditions which foster crime in the city of New York.

BUSINESS NEWS.

The Eclipse Sectional Rainbow Gasket for steam boilers deserves the attention of steam users and engineers. Its merits are set forth in the advertisement of George B. Carpenter & Co., on page IX of our present issue. The specialties of this first-class house will be published from time to time in this journal.

The Page Belting Company, through their Western Manager, Mr. F. F. Wormer, of 165 Lake street, Chicago, have negotiated a contract with the Grand Locomotive Works, to furnish them with all the belting necessary for the operation of their machinery.

Messrs. Unger & Wigham, of No. 301 Phenix Building, Chicago, manufacturers of the Grenier patent economical cupola report their business as good, with inquiries from different parts of the country—New York, Wisconsin, Pennsylvania, Ohio, and other States. They have recently added their patent device to several cupolas of other manufacturers, and they have given eminent satisfaction. Their local trade is fair, with prospects of an increased volume of business, as the season advances.

Messrs. H. R. Walker & Co., of Nos. 324 and 325 Phenix Building, Chicago, manufacturers of smoke preventing furnaces and railroad supplies, are having a fair share of business, they say. They have just completed the equipment of all the switch engines of the Chicago, Milwaukee & St. Paul railroad with their automatic smoke consumer; and they have a number being tested on other roads. Those they have applied to the Chicago, Milwaukee St. Paul railroad, they say, have given such unqualified satisfaction, that they have been substituted for others.

The Chicago Steel and Iron Roofing Co., whose office is in the Boylston Building Dearborn street, and whose factory is at Nos. 376 to 384, corner South Canal and Polk streets, Chicago, manufacturers of steel and iron roll cap roofing, pressed corrugated iron, iron doors, shutters, etc., are shipping goods to Ohio, Kansas, Illinois, Iowa, Michigan, Nebraska, Oregon, Mississippi, and Alabama. The special demand is more in the line of corrugated iron, for roofing and elevator work. Their city trade has been hitherto excellent, but just at this juncture is comparatively quiet They are now getting out a new sheet metal lath, for plastering purposes, which will soon be illustrated and described in the American Engineer.

The Chicago Raw Hide Manufacturing Co., the well-know manufacturers of rawhide belting, lace leather and rope, lariats and other rawhide goods, whose offices are at Nos. 75 and 77 East Ohio street, Chicago, are having an excellent run of business, and are full of orders in all departments. They having, among their multifarious shipments made large ones of lace leather to Melbourne, Australia; 4,000 feet of belting to London, Eng., a notably large order of belting to another point in England on the immediate receipt of which an equally extensive order was dispatched duplicating the original one. Their goods are in general demand in this country from Maine to California as well as South and North, and East. They have now in hand, in process of execution, the manufacture of a very large driving belt, for a prominent Chicago house, and another for a Detroit packing house. Their trade in halters for horses alone, for the past two months, shows an average for the year of a business aggregating $50,000. We are informed that they have an accumulation of contracts actually in hand, and in the course of settlement, to keep them busy all through the winter.

Map of the United States.

A large, handsome map of the United States, mounted and suitable for office or home use, is issued by the Burlington route. Copies will be mailed to any address on receipt of 12 cents in postage by P. S. Eustis, Gen'l Pass. Agent, C., B. & Q. R. R., Chicago, Ill.

FIRST-CLASS MACHINIST WANTED.

WANTED.—No. 1 Machinist with good education, practical, progressive and pushing; willing to receive orders; work for Company's interest. Living cheap, climate good. State wages and experience and give reference.

Address "LATHE," care of the American Engineer, Pontiac Building, Chicago.

RESPONSIBLE POSITION WANTED.

Mechanical Engineer, competent to design, construct, estimate cost, supervise erection, etc., of general machinery and wrought iron work, with practical and theoretical experience, desires a responsible position in any part of the country. Ad. M. E., care of the American Engineer, Pontiac Building, Chicago.

CHICAGO, MILWAUKEE & ST. PAUL RAILWAY.

Electric Lighted and Steam Heated Vestibuled Trains, with Westinghouse Air Signals, between Chicago, St. Paul and Minneapolis, daily.

Electric Lighted and Steam Heated Vestibuled Trains between Chicago, Council Bluffs and Omaha, daily.

Through Vestibuled Sleeping Cars, daily, between Chicago, Butte, Tacoma, Seattle, and Portland, Ore.

Solid Trains between Chicago and principal points in Northern Wisconsin and the Peninsula of Michigan.

Daily Trains between St. Paul, Minneapolis and Kansas City via the Hedrick Route.

Through Sleeping Cars, daily, between St. Louis, St. Paul and Minneapolis.

The finest Dining Cars in the World.

The best Sleeping Cars. Electric Reading Lamps in Berths.

6,100 miles of road in Illinois, Wisconsin, Northern Michigan, Iowa, Minnesota, Missouri, South Dakota and North Dakota.

Everything First-Class.

First-Class People patronize First-Class Lines.

Ticket Agents everywhere sell Tickets over the Chicago, Milwaukee and St. Paul Railway.

CONTRACTS OPEN.

Sealed Proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock p. m., on the 9th day of January, 1892, for all the labor and materials required to complete the Cut Stone Work and Brick Work of the Superstructure of the U. S. Custom House and Post Office building at Newark, N. J., in accordance with drawings and specifications, copies of which may be had on application at this office, or the office of the Superintendent at Newark, N. J. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal. The Department will reject all bids received after the time herein stated for opening same; also all bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in envelopes, sealed and marked, "Proposal for Cut Stone Work and Brick Work of the Superstructure of the U. S. Custom House and Post Office, building at Newark. N. J." and addressed to W. J. EDBROOKE, Supervising Architect.

Sealed Proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock p. m., on the 5th day of January, 1892, for all the labor and materials required for furnishing and erecting complete, the hydraulic passenger elevator, including pump, tanks, piping, car, inclosure of well hole, changes in connections, etc., of boiler plant of the building, changing of fourth-story stairs, and removal and re-construction of water-closet in basement of the U. S. Post Office and Court House, building at Peoria, Ill., in strict accordance with the drawings and specifications, copies of which may be had at this office, or the office of the custodian at Peoria, Ill. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the bid. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in envelopes, sealed and marked, "Proposals for Hydraulic Passenger Elevator, etc., add removal and re-construction of water-closet in basement of the U. S. Post Office and Court House building at Peoria, Ill.," and addressed to W. J. EDBROOKE, Supervising Architect.

Sewage Pumping Engines.—Sealed proposals will be received by the city of Chicago Office of the Department of Public Works, until 11 a. m. Tuesday, Dec. 29, 1891, for the construction, delivery and erection, upon and within the foundations provided by the city of Chicago, of two "Sewage Pumping Engines" and three boilers, together with the necessary feed pumps, pipes, etc., and complete in all details and particulars for constant daily use in connection with the web well and discharge conduit provided by the city of Chicago.

One engine to have a capacity to raise 12,000,000 U. S. gallons 15 feet high every 24 hours.

One engine to have a capacity to raise 24,000,000 U. S. gallons every 24 hours.

According to plans and specification on file in the office of the department of public works of said city.

Proposals must be made out upon blanks furnished by said office, and be addressed to said department, indorsed, "Proposals for Sewage Pumping Engines," and be accompanied with $1,000 in money, or a certified check for the same amount on some responsible bank doing business in the city of Chicago, and made payable to the order of the commissioner of Public work.

The commissioner of public works reserves the right to reject any or all bids.

No proposal will be considered unless the party offering it shall furnish evidence satisfactory to the commissioner of public works of his ability, and that he has the necessary facilities, together with sufficient pecuniary resources, to fulfil the conditions of the contract and specifications, provided such contract should be awarded to him.

Companies or firms bidding will give the individual names as well as the name of the firm, with their address.

J. FRANK ALDRICH, Commissioner of Public Works.

Comptroller's Office,
City of New Orleans,
New Orleans, Nov. 20, 1891.

Sealed Proposals will be received at this office until the hour of 12 m., Thursday, February 18, 1892, for the construction of a new drainage pump, in accordance with plans and specifications on file in the office of the City Engineer. Copies of plans and specifications will be forwarded by mail on request.

A deposit of $200 will be required to accompany each bid.

The city reserves the right to reject any and all bids.

All in conformity with Ordinance No. 5753, C. S., adopted Nov. 10, 1891.

F21 Otto Thoman, Comptroller.

Drawbridge.— Competitive plans for a drawbridge across the Duluth ship canal will be received by the board of public works in and for the corporation of the city of Duluth, Minn., until 2 p. m. on the 28th day of Debember, 1891, said plans to be drawn according to notes and specifications for the size and strength now on file in the office of said board, which will be furnished upon application. A cash prize of one thousand (1,000) dollars will be paid for the best plans furnished. Said plans must be accompanied with detail specifications and approximate cost of said bridge. The successful bidder in all probability will, if so desired, be engaged by the city of Duluth when the bridge is built to superintend the building of the same.

Official Seal. Henry Truelsen, President T. W. Abell, Clerk, Board of Public Works.